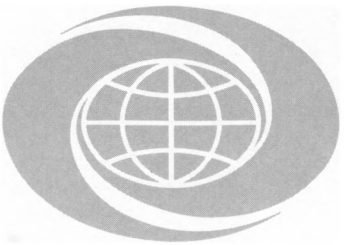

The World Book Encyclopedia

Ci-Cz Volume 4

Field Enterprises Educational Corporation
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The World Book Encyclopedia

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CIARDI, *chee AHR dee*, **JOHN** (1916-), is an American poet. Unlike the work of many modern poets, Ciardi's poetry usually is not difficult or surprising. Critics have praised his verse for its musical grace and ease. According to Ciardi, style should serve the purposes of the subject rather than express the individuality of the writer. Critics sometimes accused him of sentimentality, but he achieved the highest excellence in many of his poems and in his translations of Dante's *Divine Comedy* (*Inferno*, 1954; *Purgatorio*, 1961; *Paradise*, 1970). A representative collection of Ciardi's poetry appears in *As If: Poems New and Selected* (1955).

Ciardi was born in Boston. He taught at Rutgers University from 1953 to 1961, and became poetry editor for *The Saturday Review* in 1956. Ciardi has written several children's books. He also wrote *How Does a Poem Mean?* (1959), a critical introduction to the study of poetry at the college level. MONA VAN DUYN

CIBBER, COLLEY. See POET LAUREATE; POPE, ALEXANDER.

CIBOLA, *SEE boh lah*, **SEVEN CITIES OF.** The Spanish conquerors of Mexico came to believe in a sort of fairy tale concerning seven wonderful cities in what is now the Southwest United States. These cities were said to have great riches. One expedition set forth for the cities, guided by a black Moorish slave named Estevanico, also called Estéban. The Moor, with Cabeza de Vaca and two others, had survived a shipwreck on the Texas coast, and wandered for several years before being rescued. Estevanico led the conquerors to the seven Zuñi Indian villages in the area where Gallup, N.M., now stands. In 1540, the explorer Francisco Coronado started with his army for the fabulous cities. He, too, found only the simple Indian settlements. The only jewels the Zuñis had were turquoises, not the emeralds Coronado had hoped to find. See also CORONADO, FRANCISCO VÁSQUEZ DE; ESTEVANICO. RICHARD A. BARTLETT

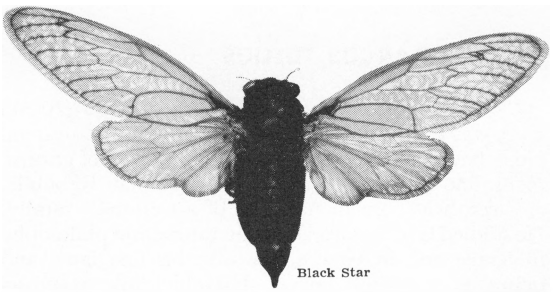
CICADA, *sih KAY dah*, or *sih KAD ah*, or HARVEST FLY, is a heavy-bodied insect with four thin wings that it folds over its body like a roof. The cicada is a darkly colored insect from 1 to 2 inches (2.5 to 5 centimeters) long. Its head is short and wide and its *antennae* (feelers) are short and bristlelike. Most cicadas live in tropical and subtropical countries, but many types live in North America.

Cicadas are commonly known for the buzzing song the male makes. The male makes a drum-like *membrane* (thin sheath of skin) on the abdomen vibrate rapidly to produce the sound. The sound attracts females or calls large numbers of males together. Each *species* (kind) of cicada has its own song. Many types of male cicadas often assemble in large groups and produce a loud chorus of sounds. Most cicadas produce a short "protest" sound if they are disturbed.

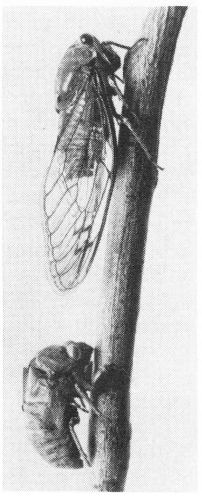
Cornelia Clarke

Periodical Cicada Nymph

Types of Cicadas. Two common groups of cicadas are the *dog-day* cicadas and the *periodical* cicadas. *Dog-day cicadas* are large, very dark, and often have greenish markings. They appear each year in July and August. It takes from two to five years for a dog-day cicada to develop from an egg into an adult. But some adults are seen each year, because different *broods* (groups of young) develop at different times. *Periodical cicadas* are dark, and have red eyes and wing veins. They appear in late May and early June. Periodical cicadas take either 13 years or 17 years to develop, depending on their species. Cicadas that take 17 years to develop are also called *17-year locusts*. Adult periodical cicadas appear in a region only once every 13 or 17 years. But so many broods exist that they appear somewhere in the United States nearly every year.



Black Star



Cornelia Clarke

A Cicada Sheds Its Skin, *right*, and emerges as an adult. Several hours later, the insect develops brilliant red, white, green, or brown markings. The adult cicada, above, mates and then dies before winter.

Development. A female cicada lays her eggs in the twigs of trees and shrubs. She places the eggs in small holes that she makes with a sawlike organ near the tip of her abdomen. The twigs usually are so badly injured by the process that the tips of the twigs die. In a few weeks, the eggs hatch and young cicadas called *nymphs* appear. They fall to the ground, enter the soil, and feed on roots. A nymph remains in the ground until it is full-grown. Then it comes out of the ground, climbs a tree or some other object, sheds its skin, and emerges as an adult. The adult cicada lives only a few weeks.

Scientific Classification. Cicadas belong to order *Homoptera*, the cicada family, *Cicadidae*. The most common dog-day cicadas belong to the genus *Tibicen*. The periodical cicadas belong to the genus *Magicicada*. DONALD J. BORROR

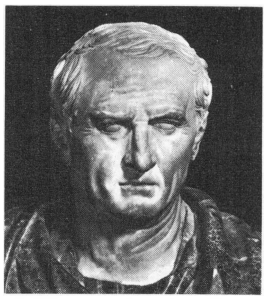
CICELY, *SIHS uh lee*, or CHERVIL, is a perennial European herb with fragrant leaves that smell much like anise. It is sometimes called *sweet cicely*, or *sweet chervil*. It grows about 3 feet (91 centimeters) high and has downy gray leaves and small white flowers. The Scottish people call it *myrrh*. The roots and seeds are used for flavoring. Europeans use the leaves in soups and salads. In the United States, the name sweet cicely is given to a closely related group of herbs used for seasoning.

Scientific Classification. Cicely is a member of the parsley family, *Umbelliferae*. It is classified as genus *Myrrhis*, species *M. odorata*. American sweet cicely is classified as *Osmorhiza longistylis*. HAROLD NORMAN MOLDENKE

CICERO, MARCUS TULLIUS

CICERO, *SIHS uh ROH,* **MARCUS TULLIUS** (106-43 B.C.), was a distinguished Roman orator and statesman. He believed sincerely in the republican form of government, and fought to save the dying Roman Republic.

Cicero was born in Arpinum of a well-to-do family. He studied law, oratory, Greek literature, and philosophy in Rome and in Greece. He won his first fame and riches as a defense lawyer. His chief role as prosecutor was in representing the people of Sicily against Gaius Verres, robber-governor of the island. Cicero was so effective that Verres went into exile without awaiting a verdict.



Marble sculpture by an unknown Roman artist; Uffizi Gallery, Florence (Alinari from Art Reference Bureau)

Marcus Tullius Cicero

Political Career. Cicero gained the office of praetor in 66 B.C. and consul in 63 B.C. As consul, he crushed the conspiracy of Catiline against the republic; his greatest speech at this time was his "First Oration Against Catiline."

Cicero was not well liked by the conservative nobles, but he refused to join Julius Caesar, Pompey, and Crassus in the First Triumvirate in 60 B.C. (see TRIUMVIRATE). As a result, he was banished from Rome during 58-57 B.C., and played only a small role in the struggle between Caesar and Pompey. He turned to writing essays on philosophy, oratory, political theory, and theology. These have had great influence on later writers. His letters, of which almost 1,000 survive, give an excellent picture of the times, and reflect his feelings and cultured outlook.

Caesar and Cicero were reconciled after Pompey's defeat at Pharsalus in 48 B.C. But Cicero approved of Caesar's murder, and for a short time in 44 B.C., he was the real, though unofficial, leader of the Senate. He launched a great attack on Mark Antony in a series of 14 speeches, known as the *Philippics,* which drove Antony out of Rome. But Cicero's triumph was short-lived, and this attack caused his downfall.

In 43 B.C., Octavian (later the Emperor Augustus), Antony, and Marcus Aemilius Lepidus formed the Second Triumvirate. Cicero was one of many they condemned to death. While trying to escape from his home in Tusculum, he was slain.

His Place in Literature. Cicero ranks among the greatest of ancient writers, and his eloquent orations are unsurpassed in Roman literature. He was responsible for developing a style in Latin prose that has become the basis of literary expression in the languages of Europe. His orations have been among the most commonly studied Latin works. CHESTER G. STARR

See also CAESAR, JULIUS; CATILINE; ORATORS AND ORATORY; POMPEY THE GREAT; ROSCIUS, QUINTUS.

CID, *sihd,* **THE** (1040?-1099), or EL CID, is one of Spain's national heroes. His real name was Rodrigo Díaz. *The Cid* comes from the Arabic *El Sayyid,* meaning *the lord.* The Cid served in the army of Sancho II of Castile. When Sancho was murdered, his hated brother Alfonso became king and banished The Cid. The Cid then gathered a small army and fought for anyone who hired him. In those times, the Moors held a large part of Spain. Soon The Cid gained great power and wealth. In 1094, he conquered Valencia from the Moors.

The Cid's story became a legend in *Poem of the Cid,* written about 1140, and in many later ballads. His story also inspired a drama by Pierre Corneille and an opera by Jules Massenet. The Cid was born near Burgos, and is buried there (see BURGOS). ARTHUR M. SELVI

See also SPANISH LITERATURE (Early Medieval).

CIDER is the fermented, or partially fermented, juice of apples. Fully fermented apple juice is called *hard cider* or *extra dry cider,* and contains 2 to 7 per cent of alcohol. Late apples or winter varieties make the best cider, because they have higher fruit-sugar content and superior flavor. The apples are crushed and then subjected to pressure in a cider press to obtain the juice. The unfermented juice is apple juice, frequently miscalled *sweet cider.* See also VINEGAR. WALTER H. HILDICK

CIENFUEGOS, *syen FWAY gohs* (pop. 85,248), is the principal sugar-exporting port on Cuba's southern coast. The city lies about 140 miles (225 kilometers) southeast of Havana (see CUBA [political map]).

Cienfuegos was founded in the early 1500's but did not become heavily populated until French refugees arrived from Santo Domingo in 1819. In 1957, supporters of Fidel Castro—then the leader of a band of Cuban rebels—revolted in Cienfuegos against the military dictatorship of Fulgencio Batista. The rebels held the city for a day and then retreated after heavy bombing by the Cuban air force. IVAN A. SCHULMAN

CIERVA, JUAN DE LA. See AUTOGIRO.

CIGAR, *suh GAHR,* is a small, tight roll of cured tobacco leaves. The word *cigar* comes from the Spanish *cigarro.* In 1492, Christopher Columbus and his men found the people of the West Indies islands smoking crude cigars. They used these early cigars in tribal ceremonies. Cigars are made by binding tobacco leaves together. The *filler* (inner leaves) is covered with the *wrapper* (outer leaf). See also TOBACCO; CUBA (picture: World-Famous Havana Cigars). ROY FLANNAGAN

CIGARETTE, *sihg uh REHT,* is a roll of shredded tobacco wrapped in paper. Virtually all cigarettes smoked in the United States are "domestic blends." They are made of flue-cured Bright tobacco (grown in Virginia, North Carolina, South Carolina, Georgia, and Florida), and burley tobacco (grown in Kentucky and Tennessee). They also have small amounts of Maryland and Turkish leaf. The blend is usually sprayed with flavoring and a moisture-retaining agent.

Cigarette smoking became common among Europeans after French and British soldiers adopted the habit from Turkish officers during the Crimean War of 1853-1856. Hand-rolled cigarettes achieved limited popularity in the United States between 1855 and 1885. They contained either straight Turkish tobacco, straight Bright tobacco, or a blend of the two. The automatic cigarette-making machine was perfected in Durham, N.C., in 1883. Cigarette companies introduced domestic blends about 30 years later.

In the early 1960's, scientists studied the effect of smoking on health. They reported that the risk of developing lung cancer is greater for smokers than nonsmokers, and that smoking contributed to other kinds

of cancer, heart diseases, bronchitis, and emphysema. In 1965, Congress passed a law requiring manufacturers to label cigarette packages with a statement about the possibility of smoking being hazardous to health. In 1970, a new law called for the statement to read—"Warning: The surgeon general has determined that cigarette smoking is dangerous to your health." Congress also passed a law banning cigarette advertising from radio and television after Jan. 2, 1971.

See also SMOKING; CANCER (What Causes Cancer); FILTER; NICOTINE; TOBACCO.

CILIA, *SIHL ee uh,* are tiny, hairlike bits of protoplasm that project from certain kinds of cells. Cilia are slender and long, and move constantly. They can be seen only under a microscope. The motion of some cilia is wavy. Other cilia bend into the shape of a hook, then straighten out forcefully.

Cilia are found in cells of the membranes of the nose, ear, windpipe, and lungs. The wavy motion of the cilia in these organs pushes out dust, bacteria, and mucus, and keeps the passages clean. Cilia in the mouth cells of a clam fan currents of water and food into the animal. Almost all one-celled animals and many bacteria have cilia that serve as sense organs and provide a means of locomotion. TERENCE A. ROGERS

See also PROTOZOAN (The Ciliates).

CILIARY MUSCLE. See EYE (The Eyeball).

CILIATE. See PROTOZOAN (The Ciliates).

CIMABUE, *CHEE mah BOO eh,* **GIOVANNI** (1240?-1302?), an Italian painter, was the first famous painter of the city of Florence. He began an era of famous Florentine painters that included Leonardo da Vinci.

Cimabue's art does not show obvious originality. He painted in a traditional style based on the medieval art of the Byzantine Empire, and used little of the realism of the later Florentine painters. His faces and figures are the formalized types of the Byzantine period. But his works have great personal force and effect, even though the forms are traditional.

Five or six of Cimabue's works exist today. The most famous include the altarpiece of the *Madonna and Child with Angels* in the Uffizi Gallery in Florence, and frescoes of a similar subject and of the Crucifixion in the church of Saint Francis at Assisi. These works show great power and grandeur, and the *Crucifixion* combines those qualities with dramatic impact. CREIGHTON GILBERT

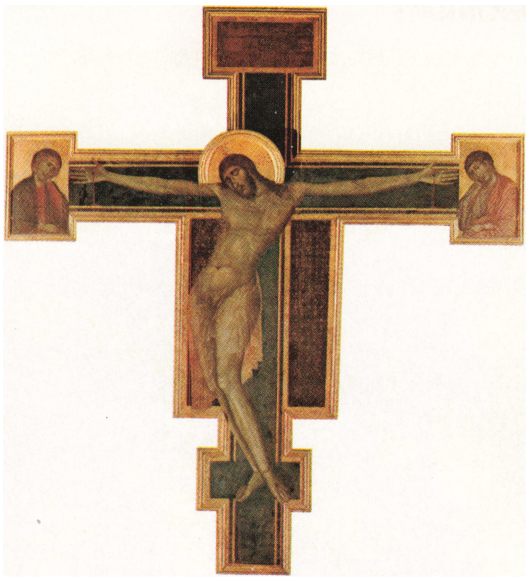
CIMBRI, *SIHM bry,* was a tribe that threatened Roman control of Italy in the 100's B.C. The Cimbri and the Teutones were driven from northern Germany by tidal invasions of the sea. The tribes roamed through central Germany to the Danube River. In 113 B.C., they defeated a Roman army that barred their entrance to Italy. The Cimbri then moved into Gaul (France).

The Cimbri destroyed two Roman armies in Arausio (now Orange, France) in 105 B.C. This was Rome's worst defeat in more than 100 years. The Cimbri still did not enter Italy, but went to Spain, where they were stopped by fierce Celtiberians.

The Cimbri, Teutones, and Tigurini finally invaded Italy in 102 and 101 B.C. The tribesmen were killed or enslaved by Roman forces under Marius. HENRY C. BOREN

CIMMERIAN is the name of a large group of nomads who invaded Asia Minor in the 700's B.C. The Greek historian Herodotus says they were chased from Russia across the Caucasus Mountains and into Asia Minor by other nomads, called the Scythians. The Cimmerians swept through Asia Minor, destroying the kingdom of Phrygia about 700 B.C. They raided Lydia in the mid-600's B.C., and terrorized western and southern Asia Minor for about 150 years, until the Lydians scattered them. The Cimmerians are called *Gomer* in the Bible.

Until the A.D. mid-1800's, scholars knew about the Cimmerians only through the writings of Herodotus and other ancient historians. Assyrian inscriptions discovered since then also mention the Cimmerians as invaders, but little else is known about them. LOUIS L. ORLIN



Tempera on wood (1295?); formerly in the Church of Santa Croce, Florence, now in the Uffizi Gallery, Florence (Art Reference Bureau)

Cimabue's *Crucifixion* shows the influence of Byzantine art. A 1966 flood in Florence, Italy, partially destroyed the painting.

CIMON, *SY mun* (507?-449 B.C.) was a military and political leader in ancient Athens. He commanded the fleet that drove the Persians from Europe in 479 B.C., during the Persian wars. Cimon helped form the Delian league, which tried unsuccessfully to unite all Greeks. Cimon was the leader of the powerful aristocrats in Athens. The aristocrats opposed reforms that Pericles, leader of the democrats, wished to make. When the democrats came to power in 461 B.C., Pericles forced Cimon into exile. Cimon returned in 451 B.C., however, and arranged a truce in a struggle between Athens and Sparta. RICHARD NELSON FRYE

CINCHONA, *sin KO nuh,* or CHINCHONA, is a group of valuable South American trees and shrubs. Cinchona bark is used to make the drugs quinine and cinchona, with which doctors treat malaria. The cinchona is an evergreen. Cinchona plants were first found in Peru and Ecuador. They are now grown in India, Sri Lanka, eastern Asia, tropical America, and parts of Africa. The flowers are usually fragrant. They vary from rose-purple to greenish-white and look like lilac blossoms.

Scientific Classification. Cinchona belongs to the madder family, *Rubiaceae.* Cinchona makes up the genus *Cinchona.* HAROLD NORMAN MOLDENKE

See also BITTERS; QUININE.

CINCHOPHEN. See ATOPHAN.

Keller Studio

Cincinnati is a major commercial and industrial center of the Midwest. The city's main business district lies on a plateau overlooking the Ohio River. Riverfront Stadium, *right*, stands nearby.

CINCINNATI is a major industrial and commercial center of the Midwest. It leads the world in the production of soap and playing cards and produces more machine tools than any other U.S. city. Among Ohio cities, only Cleveland and Columbus are larger. Cincinnati lies on the Ohio River in the southwestern part of the state. It ranks as one of the nation's most beautiful cities and was once called the *Queen City of the West*. About an eighth of Ohio's people live in the Cincinnati metropolitan area.

In 1788, settlers established a village called Losantiville on what is now the site of Cincinnati. In 1790, General Arthur St. Clair, the first governor of the Northwest Territory, changed the name to Cincinnati. He did so to honor the Society of the Cincinnati, an organization that was formed by Army officers of the Revolutionary War in America (see CINCINNATI, SOCIETY OF THE).

River trade accounted for much of Cincinnati's growth during the 1800's. Steamboats linked the city with many major ports. Later, after railroads became the chief method of transportation, Cincinnati lost much of its trade to Chicago and other cities. Since the late 1800's, the city's economy has depended largely on manufacturing.

Metropolitan Cincinnati

Cincinnati lies on the north bank of the Ohio River. The Great Miami and the Little Miami rivers flow into the Ohio on two sides of the city. Cincinnati covers 78 square miles (202 square kilometers), or about a

FACTS IN BRIEF

Population: 451,455. *Metropolitan Area Population*—1,385,103.

Area: 78 sq. mi. (202 km²). *Metropolitan Area*—2,172 sq. mi. (5,625 km²).

Altitude: 550 ft. (168 m) above sea level.

Climate: *Average Temperature*—January, 36° F. (2° C); July, 79° F. (26° C). *Average Annual Precipitation* (rainfall, melted snow, and other forms of moisture)—39 inches (99 centimeters). For the monthly weather in Cincinnati, see OHIO (Climate).

Government: Council-manager. *Terms*—2 years for the nine councilmen; manager appointed.

Founded: 1788. Incorporated as a city in 1819.

fifth of Hamilton County. The Cincinnati metropolitan area occupies 2,172 square miles (5,625 square kilometers) and extends over Hamilton, Clermont, and Warren counties in Ohio; Boone, Campbell, and Kenton counties in Kentucky; and Dearborn County in Indiana.

The City. A flat plain called the *basin* extends north into Cincinnati from the Ohio riverfront. In this area are the city's central business district, some manufacturing sections, and several old residential areas. Hills surround the basin on three sides.

Downtown Cincinnati centers around Fountain Square Plaza, between Vine and Walnut streets. The 48-story Carew Tower, the city's tallest building, rises west of the square. Fourth Street, the heart of Cincinnati's financial district, lies south of the square. The Convention-Exposition Center, which includes meeting rooms and a large auditorium, stands at the western edge of the business district. The $50-million Riverfront Stadium overlooks the Ohio River.

The Metropolitan Area. Residential areas occupy the hillsides surrounding the basin. Cincinnati suburbs include Madeira, Norwood, and Saint Bernard. Freeways connect some suburbs with the downtown district.

The People

More than 95 per cent of Cincinnati's people were born in the United States. Negroes make up about 28 per cent of the population. Most blacks live north of the downtown area. Many live in slums. About 15 per cent of the people have German ancestry. Other major groups include people of Greek, Irish, and Jewish descent.

About a third of the city's people are Roman Catholics. Other large religious groups include Baptists, Episcopalians, Jews, and Presbyterians.

Many blacks and poor whites have moved to Cincinnati from the rural South to find jobs. A large number of these people have few work skills. As a result, poverty has become the major social problem in Cincinnati.

Economy

Industry and Commerce. About 2,000 manufacturing companies operate in the Cincinnati metropolitan area. They employ more than 165,000 workers and produce about $\$2\frac{3}{4}$ billion worth of goods annually. The city ranks as the world's leading manufacturer of soap and playing cards and the nation's chief producer of machine tools. Other major Cincinnati industries manufacture automobiles and automobile parts, chemicals, clothing, cosmetics, jet engines, leather goods, and pianos. The meat-packing and printing industries also have an important part in the city's economy.

Cincinnati's port handles more than 9 million short tons (8 million metric tons) of cargo yearly. Nearly a fourth of the cargo is *bituminous* (soft) coal.

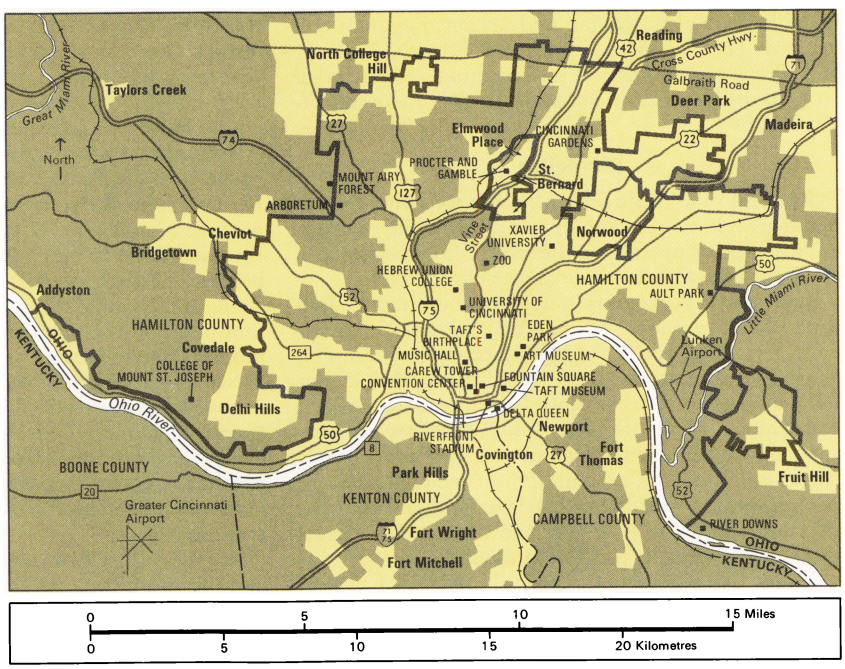
Transportation. Cincinnati links Ohio and the other north-central states with the South. Railroad passenger trains and five rail freight lines serve the city. Several major highways, including three interstate routes, pass through Cincinnati. The city owns the Cincinnati Southern Railway, which runs between Cincinnati and Chattanooga, Tenn.

Seven commercial airlines use the Greater Cincinnati Airport, which lies 10 miles (16 kilometers) outside the city in Boone County, Kentucky. The city-owned Lunken Airport, at the city's southeastern edge, handles about 200,000 take-offs and landings a year. The steamboat *Delta Queen* provides service between Cincinnati and other Ohio and Mississippi river ports.

Communication. Cincinnati has two daily newspapers, the *Enquirer* and the *Post and Times-Star*. More than 30 suburban newspapers also serve the metro-

CITY OF CINCINNATI

Cincinnati is a leading Midwest commercial center. The map shows the city, located on the Ohio River, and its main points of interest.



City boundary
County boundary
State boundary
Built-up area
Nonbuilt-up area
Main road
Other road
Rail line
Point of interest

WORLD BOOK map

politan area. The city has 16 radio stations and 5 television stations.

Education

The Cincinnati public school system includes about 110 elementary and high schools with a total of approximately 82,000 students. Negroes make up about 45 per cent of the enrollment. In many neighborhoods, the Cincinnati school board faces the problem of racially segregated schools. In addition, the board lacks enough money to cover rising costs. About 25,000 students attend more than 60 private and parochial schools in the city.

The University of Cincinnati, founded in 1819, has more than 30,000 students. In 1870, it became the first city-owned university in the United States. Other institutions of higher learning in the area include Edgecliff College and the College of Mount St. Joseph on the Ohio, both liberal arts colleges; the Hebrew Union College—Jewish Institute of Religion, the oldest Jewish theological school in the United States; and Xavier University, a Roman Catholic coeducational institution.

The Public Library of Cincinnati and Hamilton County has about 40 branches. It circulates about 6 million books, films, and other materials annually.

Cultural Life

The Arts. The Cincinnati Symphony Orchestra and the Cincinnati Summer Opera perform in Cincinnati Music Hall. The annual Cincinnati May Music Festival is also held in the hall. A local theater company presents stage dramas at the Playhouse in the Park, located in Eden Park. Touring theater groups perform at the Shubert Theatre downtown.

Museums. The Cincinnati Art Museum, in Eden Park, has more than 100 galleries of famous art works, including American Indian and ancient Egyptian collections. The Taft Museum features English, Flemish, and French paintings. The Cincinnati Museum of Natural History has a full-scale model of an underground cave.

Recreation

The Ohio River provides a setting for many recreational areas in the Cincinnati area. During the summer, excursion boats operate on the river. Many people also enjoy the several man-made lakes near the city.

Parks and Playgrounds in the area cover about 5,000 acres (2,000 hectares). Mount Airy Forest, the largest park, has about 1,500 acres (607 hectares) of camping grounds, picnic areas, and woods. Eden Park includes the Krohn Conservatory, which is famous for its tropical and seasonal plant displays. Ault Park offers open-air dancing. The Cincinnati Zoo owns one of the nation's largest collections of animals. The Cincinnati Nature Center, located near the city, has more than 500 acres (200 hectares) of rare flowers and plants. The center sponsors nature study programs in summer.

Sports. The Cincinnati Reds, the nation's first professional baseball team, meet their National League opponents in Riverfront Stadium. The Cincinnati Bengals of the National Football League also play in the stadium. The Cincinnati Stingers of the World Hockey Association play in Riverfront Coliseum.

Government

Cincinnati has a council-manager form of government. The nine-member City Council selects the city manager, who is the chief administrative officer. The council also chooses a mayor from among its members. Council members are elected to two-year terms. The city gets most of its money from a payroll tax.

In 1971, the council elected two men to split the two-year term for mayor. One of the men, Theodore M. Berry, was the first Negro to be chosen mayor of Cincinnati.

History

Early Days. The powerful Miami Indians once hunted in what is now the Cincinnati area. In 1788, a group of settlers arrived there and founded a village called Losantiville. In 1790, General Arthur St. Clair, governor of the Northwest Territory, renamed the settlement Cincinnati.

Many settlers came to the village during the late 1700's. They opened new businesses or set up farms in the surrounding area. By 1800, Cincinnati had about 2,000 persons. It was incorporated as a town in 1802.

The 1800's. Much of the town's growth during the early 1800's resulted from river trade. Steamboat service, which began on the Ohio River in 1811, permitted goods to be transported quickly and inexpensively. Cincinnati soon became an important river port and, in 1819, received a city charter. In 1827, workmen completed the first section of the Miami and Erie Canal. This canal, which connects Cincinnati with northern Ohio communities, greatly increased local trade. By 1830, the city's population had risen to nearly 25,000.

During the 1830's, thousands of Germans fled political persecution in their country and settled in Cincinnati. A large German-speaking community, known as the *Over-the-Rhine* area, grew up north of the business district. Germans contributed greatly to the cultural and economic development of the city. In the 1840's, many Irish immigrants came to Cincinnati after fleeing a potato famine in their homeland.

A number of slaughterhouses and pork-packing plants opened in Cincinnati during the 1830's and 1840's. Farmers sent their livestock, especially hogs, to be processed in the city. The meat was then shipped down the Ohio River to other ports. By 1850, Cincinnati had become the nation's chief pork-packing center.

During the mid-1800's, Cincinnati became an important point on the underground railroad, which helped runaway slaves escape to the North. Harriet Beecher Stowe gathered much material in Cincinnati for her famous antislavery novel, *Uncle Tom's Cabin*. Trade between Cincinnati and the South ended during the Civil War (1861-1865). But several of the city's businessmen made up for their losses by establishing arms and ammunition factories and selling their products to the government.

After the Civil War, trade expanded from Cincinnati into the Southwest, and the city's river traffic increased. The Art Museum, Fountain Square, and the Music Hall were built. Cincinnati also annexed more than 20 neighboring communities during the 1860's. By 1870,

the population of the city had reached about 216,000.

Cincinnati's position as an important commercial center declined during the 1870's. River trade dropped because railroads were carrying more and more freight to Chicago and other cities. Cincinnati revived its Southern markets in 1880, when the Cincinnati Southern Railway, built by the city, reached Chattanooga.

During the late 1800's, manufacturing became one of the city's main sources of income. With the growth of Procter & Gamble and other soap companies, Cincinnati's population rose to more than 325,000 by 1900.

The 1900's. During the early 1900's, many wealthy Cincinnati residents moved from the basin area to the surrounding hillsides. The riverfront became the site of factories, railroads, and shipping facilities, and the houses near the river turned into slum dwellings.

World War II (1939-1945) brought defense industries to the area. Great numbers of rural people moved to the city to take factory jobs. Most of these workers remained after the war, and the government built many low-rent apartment projects to house them. The government also rebuilt parts of the riverfront district.

Recent Developments. During the 1950's and 1960's, more and more middle-class Cincinnatians moved from old residential neighborhoods to newer areas on the hillsides. But in the late 1960's, private developers began to build new housing in the basin area and to repair old housing. This construction helped slow the moving trend. Other improvements in the central business district included elevated walkways, high-rise office buildings, and parking garages.

Traffic jams on the city's expressways became a serious problem during the late 1960's. In 1971, the U.S. Department of Transportation granted the city federal funds to start an express bus service between the suburbs and downtown Cincinnati. JESSE R. SHAFFER, JR.

CINCINNATI, SOCIETY OF THE, is the oldest military organization in the United States. Officers of the Continental Army founded it in 1783. George Washington was its first president. The name *Cincinnati* comes from the Roman hero Lucius Quinctius Cincinnatus. The city of Cincinnati, Ohio, was named for the society. The organization restricts membership to the oldest male descendants of commissioned officers in the regular forces of the Continental Army or Navy. It has about 2,400 members. Headquarters are at 2218 Massachusetts Avenue NW, Washington, D.C. 20008.

Critically reviewed by the SOCIETY OF THE CINCINNATI

CINCINNATI, UNIVERSITY OF, is a coeducational university in Cincinnati, Ohio. In 1870, it became the first municipal university in the United States. But some of its older units, such as the liberal arts college and the college of medicine, were founded in 1819. The cooperative plan of education, which combines periods of study with on-the-job experience, was introduced there in 1906. For enrollment, see UNIVERSITIES AND COLLEGES (table). WALTER C. LANGSAM

CINCINNATUS, *SIN sih NAY tus,* **LUCIUS QUINCTIUS** (519?-439? B.C.), a Roman statesman and general, was a legendary model of patriotism. In 458 B.C., Rome was threatened by the Aequi, a tribe of central Italy. The Senate sent messengers to tell Cincinnatus that he had been named commander in chief. The messengers found him plowing his fields. He joined the army at once, and marched to rescue a *consul* (chief government official) who was in great danger. Cincinnatus surrounded and defeated the enemy, marched his army back to Rome, and resigned. He returned to his farm 16 days after he took office.

George Washington was sometimes called the "American Cincinnatus" because he also held his office only as long as necessary. After the American Revolution, a group of former officers formed the patriotic Society of the Cincinnati. The city of Cincinnati, Ohio, is named after this organization. HERBERT M. HOWE

CINCO DE MAYO. See MEXICAN AMERICANS (Customs).

CINDERELLA is the beautiful but mistreated heroine of a fairy tale. Her stepmother and jealous stepsisters leave Cinderella at home when they go to the prince's ball. But Cinderella's fairy godmother turns a pumpkin into a coach and mice into horses, and dresses Cinderella in a beautiful gown and dainty glass slippers. She warns Cinderella to leave the ball by midnight.

The prince falls in love with Cinderella, and she forgets the time. Fleeing from the ball as the clock is striking 12, she loses one slipper. The prince finds her by trying the tiny slipper on every girl in the kingdom.

A similar story is told from China to Peru. Our version is adapted from Perrault's *Cendrillon* (see PERRAULT, CHARLES). GEORGE ROBERT CARLSEN

CINEMA. See MOTION PICTURE.

CINERARIA, *SIN uh RAY ree uh,* is a group of small herbs that belong to the composite family. They grow wild in the Canary Islands, but are cultivated in gardens throughout the world.

The flowers are usually purple, red, or purple and white, with dark centers. Cinerarias are easily grown from seed. They make fine window plants, but must be grown at a temperature less than 65° F. (18° C). See also COMPOSITE FAMILY.

W. Atlee Burpee

Cineraria Blossoms

Scientific Classification. Cinerarias belong to the composite family, *Compositae.* The florist's cineraria is genus *Senecio,* species *S. cruentus.* DONALD WYMAN

CINNABAR, *SIN uh bahr* (chemical formula, HgS), is the most important ore of mercury. It is a heavy compound of mercury and sulfur. Cinnabar is usually found in bright-red earthy masses, and sometimes in crystals. Artificial cinnabar may be formed by purifying a mixture of sulfur and mercury. It is brighter red than the native cinnabar, and when used in making paint, it is called *vermilion.* A. PABST

See also MERCURY (element); MINERAL (color picture); VERMILION.

CINNAMON is a spice used in cooking and in flavoring candies. It has a pleasant taste and odor. Cinnamon is made from the inner bark of branches of the cinnamon laurel tree, which grows in such tropical regions as the Malagasy Republic, Sri Lanka, and southwestern India. The cinnamon tree grows as high as 30 feet (9 meters), and has oval leaves and tiny pale-yellow

flowers. The fruit of the tree is shaped like an acorn.

Cinnamon trees grown for their bark are usually kept small, or dwarfed. This is done by cutting the tree close to the lower buds. The bark of the lower branches is peeled for use as cinnamon. In Sri Lanka, the bark is usually peeled in April and November. As the bark dries, it curls up and turns light brown. The bark is divided according to quality by people who taste samples. Then it is packed into 90-pound (40-kilogram) bundles for sale.

American Spice Trade Assoc.

Cinnamon Bark

An oil is also prepared from the leaves, fruit, and the root of the cinnamon plant. The thick, fragrant oil from the fruit was once used to make candles for the king of Ceylon (now Sri Lanka). The oil of the cassia plant is often used in place of cinnamon oil. Cassia bark sometimes replaces cinnamon bark.

Scientific Classification. The cinnamon tree belongs to the laurel family, *Lauraceae*. It is genus *Cinnamomum*, species *C. zeylanicum*. HAROLD NORMAN MOLDENKE

See also CASSIA; LAUREL.

CINQUEFOIL, *SINK foil*, is any one of a group of plants that belong to the rose family. About 250 kinds of cinquefoils grow in most cool and cold regions throughout the world. These herblike plants may grow erect, or close to the ground in creeping fashion. The leaves have three, five, or more leaflets. Because of the shape of their leaves, the plants are sometimes called *five-finger* or *false strawberry*. The bright yellow or white blossoms of the cinquefoil grow in loose clusters. Some kinds of cinquefoil are troublesome weeds.

Scientific Classification. The cinquefoils are members of the rose family, *Rosaceae*. They make up the genus *Potentilla*. EARL L. CORE

CIO. See CONGRESS OF INDUSTRIAL ORGANIZATIONS.

CION. See GRAFTING.

CIPANGO. See JAPAN (Foreign Relations).

CIPHER. See CODES AND CIPHERS.

CIRCADIAN RHYTHM. See BIOLOGICAL CLOCK.

CIRCASSIAN, *sir KASH un*, is the name of a people living on the northeast shores of the Black Sea. They are called *Cherkesses* by the Russians and Turks, but their word for themselves is *Adighe*. The Circassians are less round-headed than other Caucasians, and are the tallest and darkest of the peoples of Caucasia. They are related to the Bulgarians, Romanians, and Ukrainians. The Circassians have always been noted for the fierceness of their warriors and the beauty of their women, who are often called "Circassian belles." Circassian women were once sold into Turkish and Persian harems by their fathers. Upper-class Circassians are Moslems. The lower classes practice a mixture of paganism and Christianity. See also CAUCASIA. WILTON MARION KROGMAN

CIRCE, *SIR see*, a beautiful enchantress in Greek mythology, had the power to turn men into beasts. She lived on an island in the Mediterranean Sea. When Odysseus (Ulysses in Latin) landed on her island, Circe turned most of his men into pigs and drove them into a pigsty. But the god Hermes had given Odysseus a magic herb which protected him from Circe's power (see HERMES; ULYSSES). Odysseus forced Circe to give his men their human form again.

After that, Circe became friendly. She loved Odysseus and persuaded him to stay with her on the island for a year. When he prepared to leave, she warned him about the dangers that awaited him, and told him how to overcome them. For example, Circe told Odysseus how to pass the island where the Sirens lived by stopping his sailors' ears with wax. JOSEPH FONTENROSE

See also ODYSSEY; SCYLLA.

CIRCLE is a closed curve on a plane. All points of the curve are the same distance from a point within called the *center*. There are 360 degrees in a circle.

Many common objects have a circular shape, including rings, hoops, and wheels. You can easily draw a circle with an instrument called a *compass*. A compass looks like a pair of scissors with a pencil where one point should be. To draw a circle, place one point of the compass at the point chosen as the center, and rotate the pencil around it.

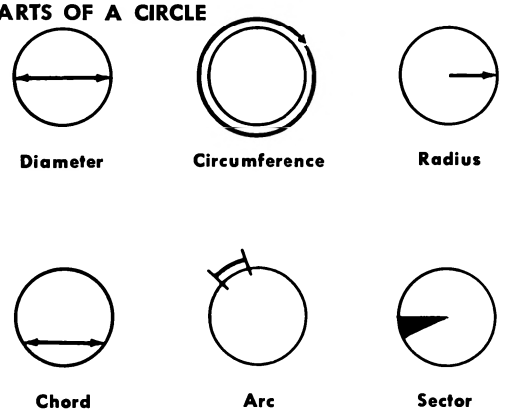
Parts of a Circle. Sometimes people use the word *circle* to mean the area inside the curve. They call the curve itself the *circumference*. The length of the curve is also called the circumference. An *arc* forms part of the circumference. It may be of any size.

A *chord* is a straight line between two points on the circumference of a circle. If a chord goes through the center, it forms a *diameter*. A diameter is the longest chord of a circle, and divides the circle into two equal parts called *semicircles*.

The *radius* is the distance from the center to the circumference. It equals half the length of a diameter. The word *radius* is also used to mean any line that joins the center to the circumference.

A *secant* is a straight line that intersects a circle at two points. A line that just touches the circle, or meets the circle at just one point, is called a *tangent*. If you move a secant away from the center of the circle so that it always lies parallel to its previous position, the two points at which it touches the circle will get closer to each other. When the points come together, the secant has reached the position of a tangent. The point where the tangent touches the circle is the *point of tangency*.

PARTS OF A CIRCLE



The radius at the point of tangency makes a right angle with the tangent.

The Use of Pi. The Greek letter *pi* (written π) stands for the number by which the diameter of a circle (d) must be multiplied to obtain the circumference (c). That is, $c = \pi d$ or $2\pi r$, where r is the radius. The area of a circle (A) is given by the formula $A = \pi r^2$.

You cannot write π exactly as a decimal. But by increasing the number of digits, you can get a number as near to it as you want. Common values used for π include $\frac{22}{7}$, 3.14, 3.1416, and 3.14159.

History. The ancient Chinese used 3 as the value of π. About 1650 B.C., the Egyptians improved on the approximation. The astronomer Ptolemy of Alexandria calculated a value for π that was the equivalent of 3.1416. After decimals came into use in the 1600's, men sought an exact decimal value for π. Mathematicians now know that this is impossible. ROTHWELL STEPHENS

See also DEGREE.

CIRCUIT, ELECTRIC. See ELECTRIC CIRCUIT.

CIRCUIT BREAKER is an automatic switch. It protects electric motors, household wiring, long-distance power lines, and other electric circuits against damage caused by too much electric current. Too much current may flow in a circuit as a result either of a fault in the circuit or of an outside event, such as lightning.

Every circuit breaker is designed to allow a specific maximum amount of electric current to pass. If the current exceeds this limit, an automatic mechanism inside the circuit breaker throws open a *set of contacts* (switch) and stops the current. Mechanisms used to open the switch include electromagnets and temperature-sensitive devices similar to a thermostat.

As the switch opens, an electric arc leaps across the open contacts. Electricity continues to flow through this arc until it is extinguished. In an *oil circuit breaker*, the switch is immersed in an oil that extinguishes the arc. In an *air-blast circuit breaker*, a blast of compressed air blows out the arc. In a *magnetic arc-suppression circuit breaker*, a magnetic field deflects and breaks the arc.

Some circuit breakers are about as small as an ordinary light switch. But some are as large as a small two-story house. A large circuit breaker can interrupt currents up to 40,000 amperes at 345,000 volts. It can open a circuit in less than $\frac{1}{30}$ of a second, and reclose it in less than $\frac{1}{3}$ of a second. WILLIAM W. SEIFERT

See also SAINT LAWRENCE SEAWAY (picture).

CIRCUIT COURT OF APPEALS. See COURT OF APPEALS.

CIRCUIT RIDER was an important figure in pioneer times in America. There were two kinds of circuit riders. One was a religious man who rode a *circuit* (regular route) conducting services. The other was a judge who rode a circuit hearing cases. Either kind of circuit might cover great distances.

Preachers, often called *backwoods preachers*, began riding circuits in what is now the United States during the 1760's. John Wesley, founder of the Methodist movement in Great Britain, sent several *lay preachers* (persons not ordained as ministers) to preach the gospel in America. Famous early circuit riders included Francis Asbury, the first Methodist bishop in the United States, and Peter Cartwright, a pioneer preacher in Kentucky and Illinois.

Judges began riding circuits in 1790. Congress divided the 13 states into three circuits, with two Supreme Court justices appointed to hear cases in each circuit. This system was changed when more states joined the Union and the Supreme Court had more work to do. Many state judges also rode circuits. Lawyers usually traveled with the judges and would argue cases brought to the court. Abraham Lincoln spent several years riding circuits as a lawyer in Illinois. CHARLTON G. LAIRD

Related Articles in WORLD BOOK include:

Asbury, Francis	Pioneer Life in America (Religion)
Cartwright, Peter	Wesley (John)
Lincoln, Abraham (Riding the Circuit)	Western Frontier Life (Religion)

CIRCULAR MEASURE. See WEIGHTS AND MEASURES (Circular and Angular Measure).

CIRCULATION is the means by which food is carried to the tissues of animals, and wastes are carried away. Even the simplest animals have some sort of a circulatory system (see INSECT [Circulatory System]).

In man, the circulatory system consists of the heart, which pumps the blood through the body, and the arteries, veins, and tinier blood vessels called *capillaries*, through which the blood travels. The human circulatory system has two main parts. One part, called *pulmonary circulation*, carries the blood from the heart to the lungs and back again. When the blood passes to the lungs, it gives off the waste gas, carbon dioxide, and takes in oxygen which it carries to the other parts of the body. The system that carries the blood from the heart to the other parts of the body is called *systemic circulation*.

The *portal circulation* is a part of the systemic circulation. It carries blood from the stomach, pancreas, small intestine, and spleen to the liver. The blood obtains the food it carries from the digestive system. Many wastes obtained from the body tissues are carried to the kidneys or to the lungs to be given off as wastes.

The human body also has another system called the *lymph system*. The fluid called *lymph* circulates between the tissues and cells that make up the body. It carries food to the cells, and carries wastes away from them. The lymph receives its food from the blood, and carries the body wastes into the blood. It also picks up fats from the small intestine.

The human heart has four chambers, two on each side. The blood enters the heart at the upper right-hand chamber, called the *right atrium* (auricle), and flows into the lower right-hand chamber, called the *right ventricle*. From here it flows to the lungs, and returns to the left atrium. It then passes into the left ventricle and out into the rest of the body through a large artery called the *aorta*. JOHN B. MIALE

Related Articles in WORLD BOOK include:

Artery	Heart	Lymphatic System
Blood (color picture)	Human Body (Trans-Vision)	Respiration
Capillary	Lung	Vein
Harvey, William		

See also *Circulatory System* in the RESEARCH GUIDE/INDEX, Volume 22, for a *Reading and Study Guide*.

CIRCUMFERENCE. See CIRCLE.

CIRCUMNAVIGATION. See EXPLORATION AND DISCOVERY (Ferdinand Magellan); DRAKE, SIR FRANCIS.

CIRCUMSTANTIAL EVIDENCE. See EVIDENCE.

Circus Posters from the Circus World Museum, Baraboo, Wis.—William R. Wilson

CIRCUS is a huge show where people see mischief-making clowns, daring trapeze artists, fearless lion tamers, and many other thrilling acts. Children in the audience nibble fluffy cotton candy and munch popcorn and peanuts. The circus band and circus stars in bright costumes add color and excitement to the show.

The circus goes back thousands of years. The ancient Romans held circuses that featured chariot races and battles between warriors. Roman circuses were held outdoors in large arenas. The largest Roman arena, the Circus Maximus, seated more than 180,000 persons.

The modern circus developed in England during the 1700's, and soon spread to America. The early circuses were small shows with riding acts, jugglers, and clowns. Rickett's circus, established in Philadelphia in 1792, may have been the first real American circus.

The golden age of the American circus began in the late 1800's. About 10 large circuses toured the country. Each circus boasted that it was the biggest or the best. And each tried to outdo the others with new acts and new kinds of animals. One of these circuses, established in 1871, belonged to Phineas T. Barnum. Barnum called it the "Greatest Show on Earth." In 1881, Barnum combined his show with James A. Bailey's circus. The combined show was called the Barnum, Bailey, and Hutchinson Circus. After 1886, this circus operated under the name of Barnum and Bailey's Greatest Show on Earth. In 1884, the five Ringling brothers started a rival show in Baraboo, Wis. The Ringlings bought the Barnum and Bailey show in 1907. They joined the two circuses in 1919 to form the Ringling Brothers and Barnum & Bailey Circus. This circus became the largest and most famous in history. The Ringling family sold it in 1967, but the name of the circus did not change.

Circuses traveled from town to town in colorful wagons pulled by horses. In each town, boys earned tickets to the circus by watering the elephants or doing other chores. The shows were held in large canvas tents called *tops*. The main circus acts appeared in the *big top*, the largest tent. The Ringling circus had a big top 500 feet (150 meters) long and 200 feet (61 meters) wide. It seated more than 12,000 persons.

Today, circuses travel by train or truck. They often perform in stadiums and auditoriums to avoid the cost of transporting and setting up tents. In 1956, the Ringling circus gave up its tent entirely and began to hold all its performances indoors. But circus fans still refer to the main showroom as the big top.

Henry Ringling North, the contributor of this article, is former Vice-President of the Ringling Brothers and Barnum & Bailey Circus. Mel Miller, the critical reviewer, is a museum designer and former Director of Special Exhibitions for the Ringling Brothers and Barnum & Bailey Circus. The illustrations are by Fred Steffen.

Robert Bradley

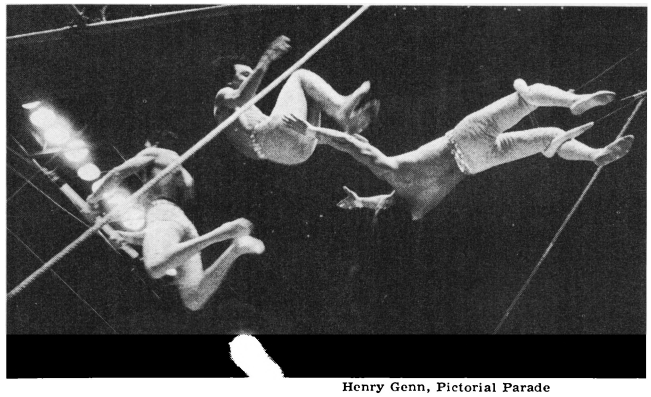
Bareback Riders form a pyramid while their horses gallop around the circus ring.

Sue McCartney, Photo Researchers

Performing Elephants put on an exciting act under the big top. The elephants do tricks in all three circus rings. A group of dancers carrying feathery fans adds color to the act.

Ike Vern, Photo Researchers

Clowns such as Lou Jacobs amuse the audience with funny tricks.



Henry Genn, Pictorial Parade

Trapeze Artists thrill the crowd by performing leaps and turning somersaults in the air.

The Parade. Circuses used to parade through the streets before a performance. The red and gold wagons, saddle horses, and elephants made a colorful sight. The circus band played spirited music. But the parades had to be discontinued in most places because city streets became crowded with traffic.

Today, the circus performance itself may begin with a parade called a *spectacle*. As the band plays a lively tune, circus performers and animals march around the arena. The elephants wear bright velvet or satin ornaments. Each elephant may have a pretty girl perched on its head, or riding in a large saddle called a *howdah*. Beautiful horses with shiny coats prance by proudly. Sometimes dozens of dancers in colorful costumes take part in the spectacle.

As the circus performers pass in review, the clowns make the audience laugh with their funny tricks. A dozen of them may pile out of a tiny car. Others may set a toy house on fire, then put out the flames with water from a miniature fire truck.

Under the Big Top. Most circus acts take place in round areas called *rings*. A small circus may have only one or two rings. Large circuses have three rings where three acts go on at the same time. There is so much to see that no one can follow everything that happens in all the rings.

In one ring, elephants stand on their hind legs and dance. In another ring, trained seals balance big rubber balls on their noses. Trained horses gallop in a circle while riders jump from horse to horse. A family of riders stand on each other's shoulders on the backs of horses trotting side by side around the ring. A lion tamer enters a cage and cracks his whip. The big cats leap onto platforms at his command.

Performers called *aerialists* climb high overhead on ropes or rope ladders. Some aerialists hang by their teeth from a rope and twirl around and around. Others, called *flyers*, leap through the air from one trapeze to another. They perform daring somersaults in the air before being caught by other members of the act. Other acts feature performers on the high wire, riding bicycles or doing acrobatics.

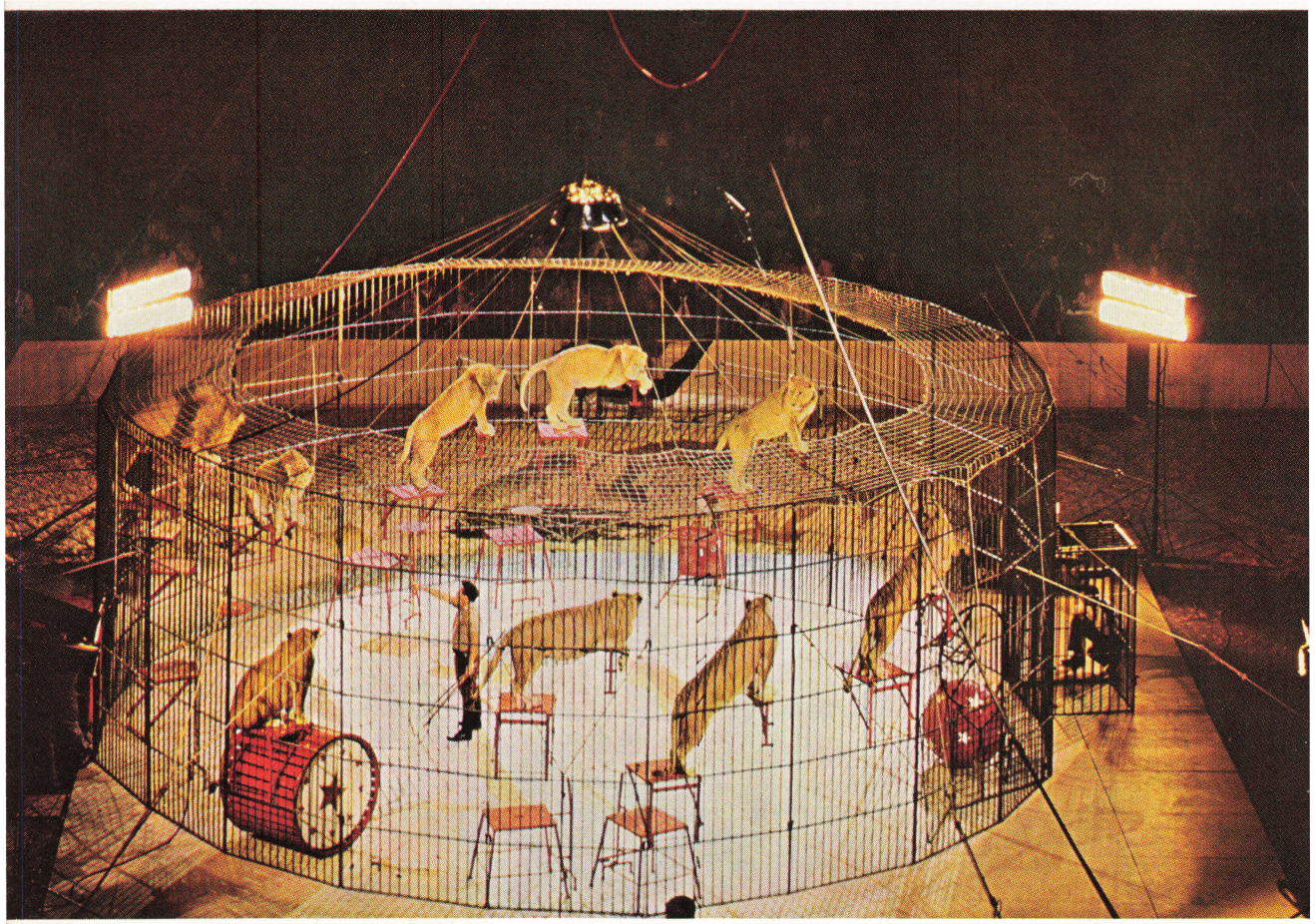
The circus band plays throughout the show. The band helps keep the different acts running on time. By playing faster or slower, or by changing songs, it signals the performers when to finish the various parts of their acts. The music keeps up the feeling of excitement and pride in showmanship that is as old as the circus itself.

WORLD BOOK photo by Joseph Janney Steinmetz

The Daring Wallendas walk slowly along a cable during practice. The family became famous for a dangerous high wire act that included a seven-man pyramid.

Martin J. Schmidt

Beauty and Beast balance on balls. Circus bears do many tricks.



Ellis Sawyer, FPG

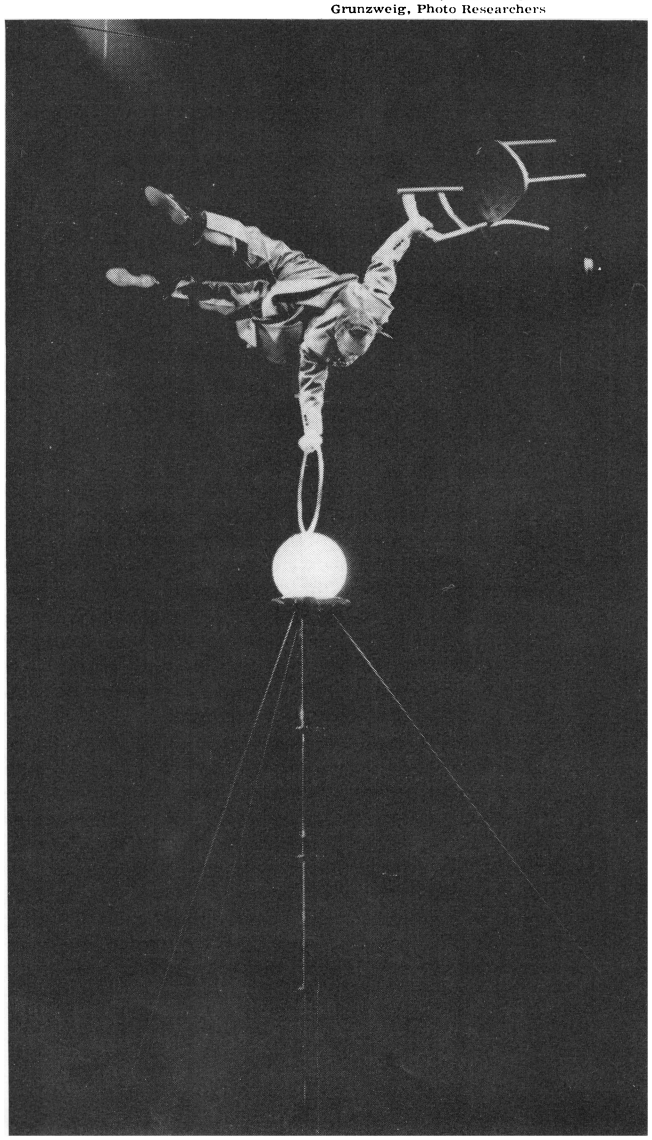
The Wild Animal Act is one of the most popular features of the circus. Lions snarl at the trainer as he enters the cage and cracks his whip. The animals perform tricks at his command.

A Side Show "Talker," *below,* attracts a crowd of circus visitors to see a snake lady. Other side show attractions, *right,* include a contortionist, a tattooed woman, a fat lady, a giant, and a midget.

Don Stebbing

Unus, a Famous Acrobat, balances on top of a hoop. He became the first circus star to do a handstand on only one finger.

Grunzweig, Photo Researchers



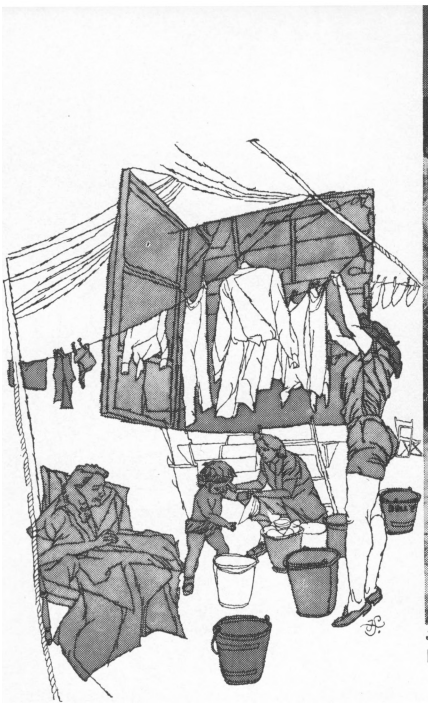
Many circus stars have become world famous. Poodles Hanneford and his family combined clowning with skillful bareback riding. Arthur Concello and his wife Antoinette won fame on the flying trapeze. Antoinette Concello became the first woman to perform a triple somersault, the most difficult trapeze stunt. Clyde Beatty and Mabel Stark became known for their acts with wild jungle animals. Famous circus clowns include Felix Adler, Otto Griebling, Lou Jacobs, and Emmett Kelly.

Franz Furstner, known as "Unus," stands on top of a pole on one finger. His daughter, Vicki, does one-armed swings while hanging from a rope high in the air. Chrys Holt performs a juggling act while hanging by her hair at the top of the tent.

Some circus acts are dangerous, and the performers risk their lives at each show. Lillian Leitzel became world famous for her breathtaking aerial act. She hung by one wrist from a rope and swung her body around and around. She fell to her death during a performance in 1931. The Wallendas, a famous circus family, developed the most spectacular high wire act in circus history. Seven of them stand on each other's shoulders, then walk along the wire. Three members of the Wallenda act were killed and one was paralyzed in two accidents during the early 1960's.

The Side Shows are smaller, separate shows near the main entrance to the big top. The side shows offer such exhibits as a snake charmer, a sword swallower, a fire eater, and a tattooed man. Also on display are human and animal freaks, including midgets, giants, a bearded lady, a fat lady, and a five-legged calf. Men called *talkers* tell the crowd about the wonders to be seen in the side shows.

Many persons visit the *menagerie* to see the circus animals up close. Fierce lions and tigers pace back and forth in cages. Elephants stick out their trunks for peanuts. Monkeys jump and climb around their cages, chattering at the crowds.

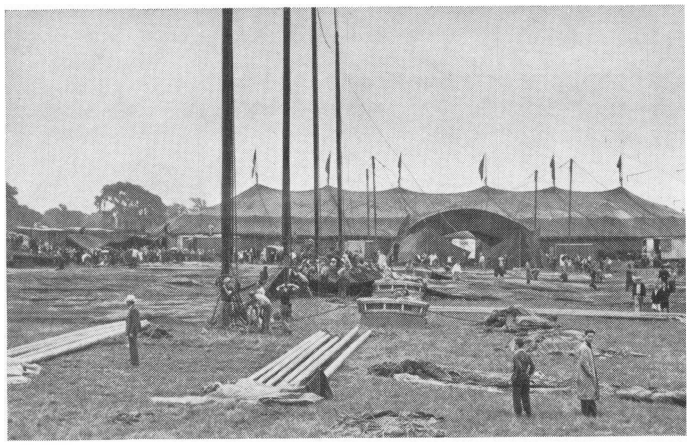


Joseph Janney Steinmetz

Between Acts, Circus Performers Rest and Talk Together.

Monkmeyer

At Winter Quarters, Riders Rehearse.



Black Star

After the Show, Roustabouts Take Down the Circus Tents.

On Tour. A circus travels most of the year, giving performances in many cities and towns. A circus that travels by train usually owns its own railroad cars. The locomotive belongs to the railroad company. The circus performers and workers ride in sleeping cars, and the animals ride in boxcars. A circus may take along its own blacksmith shop, barbershop, post office, and doctor and first-aid unit. Every day, circus cooks prepare meals for hundreds of circus people.

Before the circus comes to town, publicity men put up gaily colored posters advertising the show. As soon as the circus arrives, workmen called *roustabouts* begin to unload the equipment and set it up. If the circus uses tents, machines help unload great sections of canvas and drive the tent stakes into the ground. The roustabouts have plenty of work even if the show is given in a building, rather than "under canvas." After the last performance on the final day, the roustabouts quickly take everything down so it can be moved on to the next city.

Circus people work together like members of a huge family. Sometimes even the stars of the show perform in acts besides their own, or help with the everyday circus chores. For example, a trapeze artist may ride an elephant in the elephant act. A clown may spend some time every day brushing the circus horses.

Circus stars often teach their acts to their children. When the children grow up, they carry on the traditional family acts, such as the Wallendas' high wire act. Sometimes aunts, uncles, cousins, and other relatives become members of a family act.

Winter Quarters. Late in the fall, the circus gives its last performance of the season and heads for its winter quarters. But the busy life of the circus people does not slow down for long. Soon they are hard at work preparing for the next season. Wild animal trainers begin to train new jungle beasts. The flyers, acrobats, and other circus stars practice for several hours every day. The clowns plan new stunts. Hundreds of other circus workers design and sew costumes, purchase and mend

equipment, and take care of the animals in the circus.

The circus winter quarters look like a small city. They have streets and shops, large storehouses, barns for the animals, and a ring where the circus stars practice their acts. Many circus people live nearby in houses and trailers. The Ringling Brothers and Barnum & Bailey Circus has winter quarters at Venice, Fla. Thousands of tourists go there each year to watch the circus rehearse and to see how circus people live.

Many tourists also visit the Circus Hall of Fame and the Ringling Museum of the Circus in Sarasota, Fla. This museum has displays of historic circus posters, documents, wagons, and equipment.

In spring, the circus goes on tour again. A crowd at the railroad station watches as people and animals board the circus train. A minister or priest blesses the show. Then the circus starts on its yearly tour that brings delight to millions of circus fans. HENRY RINGLING NORTH

Critically reviewed by MEL MILLER

Related Articles in WORLD BOOK include:

Barnum, Phineas Taylor
Buffalo Bill
Clown
Elephant (picture)
Florida (Places to Visit)
Giant (picture: The Long and Short of It)
Hagenbeck, Karl
Lion (Training Lions)
Ringling Brothers
Roman Empire (Family Life)
Stratton, Charles S.
Wisconsin (Places to Visit)

Outline

I. The Greatest Show on Earth
A. The Parade
B. Under the Big Top
C. The Side Shows
II. Behind the Scenes
A. On Tour
B. Winter Quarters

Questions

Where were the first circuses held?
What does a *roustabout* do?
How many rings does a large circus have?
What is a *top* in a circus?
What act made Antoinette Concello famous?
How does the band keep the circus running on time?
What animals perform in circuses?
Why is Phineas T. Barnum famous in circus history?
What do circus people do in winter?
What exhibits appear in side shows?

CIRCUS MAXIMUS. See HIPPODROME.

CIRE-PERDUE. See SCULPTURE (Greek Sculptors).

CIRQUE. See GLACIER (Erosion).

CIRRHOSIS, *suh ROH sihs*, is a disease of the liver in which scar tissue forms throughout the organ. Groups of hard cells called *regenerative nodules* replace the normal spongy tissue of the liver. The diseased organ may be unable to perform such functions as manufacturing proteins and removing harmful substances from the blood. The affected tissue may block the flow of blood, causing high pressure in blood vessels that serve the liver. Internal bleeding may result. The blockage also may lead to the accumulation of fluids in the abdomen.

Many persons with severe cirrhosis lose weight and become weak. Severe cirrhosis can cause death. But some cases of cirrhosis do not even cause noticeable symptoms.

Cirrhosis results from injury to the liver. Such injury may be caused by excessive use of alcoholic beverages, by diet deficiencies, or by *hepatitis*, an inflammation of the liver. Inhaling the fumes of certain chemicals, such as carbon tetrachloride, causes some cases of cirrhosis. After scar tissue forms, the liver cannot regain its sponginess. Some cases of cirrhosis can be controlled by drugs, proper diet, and avoiding liquor. A. WILLIAM HOLMES

CIRRUS. See CLOUD.

CISLUNAR SPACE. See SPACE TRAVEL (What is Space?).

CISTERCIANS, *sihs TUR shuhnz*, are members of a Roman Catholic order of men called the Order of Cîteaux (Cistertium). The brotherhood was founded at Cîteaux, France, in 1098 by Saint Robert of Molesme, and later developed by Saint Alberic and Saint Stephen Harding. The Cistercian monks observe the Rule of Saint Benedict, which emphasizes moderation. They maintain silence except in cases of absolute necessity. They do not eat flesh, fish, or eggs, and they participate in much outdoor work, especially farming. There are about a hundred Cistercian monasteries. The Cistercian nuns observe the same regulations as the monks, and live contemplative lives. The Trappists, who have monasteries in the United States, are a branch of the Cistercian order (see TRAPPISTS). FULTON J. SHEEN

See also BERNARD OF CLAIRVAUX, SAINT.

CISTERN. See RESERVOIR.

CITADEL, *SIT uh dell*, is a high, walled fortress built to defend a city. A citadel usually stands on a high hill overlooking a city. In early days, its walls surrounded and protected the palace of the ruler. The citadels of Mycenae and Tiryns in Greece were important ancient fortresses. The citadel known as Acrocorinth, on a hill more than 1,800 feet (549 meters) high, guarded the Greek city of Corinth. The French citadel of Carcassonne was an important stronghold during the Middle Ages.

The best-known citadel in North America stands atop Cape Diamond in Quebec, Canada. The French built it about 1665, and the British rebuilt it from 1823 to 1832. La Citadelle in Haiti is another famous citadel of the Western Hemisphere. CARL K. HERSEY

See also ACROPOLIS; CARCASSONNE; QUEBEC (The City; Annual Events and Places to Visit).

CITADEL, THE, is the Military College of South Carolina in Charleston. It was established in 1842 and is controlled and supported by the state. It offers courses in the arts, sciences, engineering, and business administration. The Citadel has Army and Air Force ROTC units. For enrollment, see UNIVERSITIES AND COLLEGES (table). MARK W. CLARK

CITIES. See CITY.

CITIES OF REFUGE were six cities of ancient Palestine. They were set apart as places of refuge for people who had killed other persons either accidentally or in self-defense. They included Bezer, Ramoth-Gilead, and Golan, on the east side of the Jordan (Deut. 4:41-43), and Kedesh, Shechem, and Hebron (now Al Khalīl), on the west side (Josh. 20). A person who fled to one of these cities received a fair trial. If found not guilty of willful murder, he might continue living in the city. If declared guilty, he was returned for punishment to the place from which he had fled. LOUIS L. MANN

CITIZEN KING. See LOUIS PHILIPPE.

CITIZEN OF THE WORLD, THE. See GOLDSMITH, OLIVER.

WORLD BOOK photo by Henry Gill

Training for Citizenship is a basic goal of the educational systems of democratic countries. In this mock legislative session, students learn about the art of government. Student councils and other school organizations also provide opportunities to practice good citizenship.

CITIZENSHIP

CITIZENSHIP means full membership in a country. The word *citizenship* comes from the Latin word *civitas*, meaning *citizens united in a community*. Citizenship is still sometimes used to mean membership in some smaller unit of government, such as a state, province, or city. A person who holds the legal position of citizenship is called a *citizen*. A country grants certain rights to its citizens, and demands certain duties from them.

A country offers its citizens protection when they are away from it and privileges when they are at home. A country and its citizens are not really separate. A country exists only when the people of a certain area are organized politically.

Not all persons living under the same flag are citizens. Persons who are not citizens may be either aliens or noncitizen nationals. *Aliens* are persons from other countries who have not become citizens of their new country. *Noncitizen nationals* are persons who are not citizens of a country, but owe allegiance to it. The government protects them, but they do not have the full privileges of citizens. For example, the people of American Samoa are noncitizen nationals.

What Is Good Citizenship?

Rights and Duties. Citizenship involves both civic and political rights, as well as civic and political duties. Bills of rights in the United States Constitution and in state constitutions guarantee *civic rights* to all Americans. These bills of rights offer protection and give privileges (see BILL OF RIGHTS). A person possesses civic rights, such as the right to worship as he pleases, from the day he is born. In return for these rights, each citizen owes allegiance to his country. It is his *civic duty* to support his government, obey its laws, and defend his country.

Only citizens have full *political rights* (the rights to take part in the government). These rights have some limitations. In the United States, for example, a citizen must be 18 years old before he can vote. Also, every state requires its citizens to establish a permanent residence in order to vote. These restrictions in no way lessen the citizen's civic and political duty to help elect officers of his government when he becomes eligible to vote.

Citizens can carry out their civic responsibilities in many ways besides voting. They can help shape public opinion by using their freedom of speech and expressing their views on important issues. Young men may be called on to serve in the armed forces. Adults may serve on juries, become school board members, participate in community fund drives, or work for the political party of their choice.

Du Pont

In the Community, all citizens have civic duties. Adult citizens may be called to serve as members of juries in trials.

National Safety Council

In Everyday Life, good citizens obey laws. Boys and girls learn responsibility by serving in the school safety patrol.

Education for Citizenship. Democratic government fails unless citizens show the same eagerness to serve their country that they expect the country to show in serving them. Schools seek to train young citizens to accept their responsibilities. Most schools have civic-education programs that emphasize citizenship activities. Students study current affairs and American history and government. They often have opportunities to elect class officers, make plans and decisions, and discuss matters that concern them as a group. Students also take part in bands, clubs, athletic teams, and student government. They work together on projects to study such problems as environmental pollution.

Many private and public organizations promote citizenship education. They help citizens get information about their government and encourage them to take part in the government. Many groups sponsor conferences, exhibits, and discussions. Others distribute pamphlets and send representatives to government hearings on proposed bills. Some groups hold *mock conventions* or *mock legislatures* that train young men and young women on how a government operates.

Governmental and private organizations work with aliens in the Americanization program. The Americanization program helps qualified aliens prepare for American citizenship.

How Citizenship Is Acquired

A person becomes a citizen of a country by *birth* or by *naturalization.* Every country has its own citizenship laws. The United Nations, recognizing the conflicts in citizenship laws throughout the world, tries to promote a uniform arrangement.

Birth. Nations generally follow one or both of two rules regarding citizenship by birth. The rule of *jus soli* (place of birth) provides that any person born within a country's boundaries is a citizen of that country, regardless of the nationality of his parents. The rule of *jus sanguinis* (blood relationship) provides that a child's citizenship is determined by his parents' nationality, regardless of his place of birth.

Some countries use both rules. They may do so in order to increase the number of their citizens, or to prevent hardships resulting from conflicting rules. The United States and Canada emphasize *jus soli*, but also follow a modified version of *jus sanguinis.*

Some countries, such as Great Britain, follow primarily the rule of place of birth. The British consider that anyone born "under the British flag" is a subject of the Crown, regardless of the nationality of his parents. Many other European countries, such as France, follow the rule of blood relationship. The French regard anyone born of French parents anywhere in the world as a French citizen. France also uses the rule of *jus soli.*

Naturalization. Many countries grant citizenship to aliens who meet certain requirements that guarantee their loyalty. This procedure is called *naturalization.* An alien who qualifies for naturalization must renounce all allegiance to the country of his birth. He takes an oath of loyalty to his new country in a formal ceremony. In the United States, naturalization ceremonies are often performed on Citizenship Day, September 17.

Special Legislation that *waives* (excuses) one of the regular requirements for naturalization may be passed by Congress. Each year, congressmen propose about 500 special acts to allow designated aliens to become naturalized citizens without meeting one of the usual requirements.

Cession of Territory may result in another form of naturalization. An act of Congress or a treaty can confer citizenship on an entire group of people. When the United States bought the Louisiana Territory from France in 1803, the treaty provided that all the people in the area become American citizens.

United States Citizenship

Under the Constitution. The 14th Amendment to the United States Constitution established the principle of *jus soli* in the United States. It states that "All persons born or naturalized in the United States, and subject to the jurisdiction thereof, are citizens of the United States and of the State wherein they reside."

William E. Sauro, *The New York Times*

Voting is the means by which citizens choose their government leaders. People also vote on such matters as proposed laws and whether to issue bonds to pay for a new school.

The 14th Amendment makes clear that state citizenship is a by-product of national citizenship. Every U.S. citizen is also a citizen of the state in which he lives. He is entitled to all the rights and is bound by all the obligations granted or imposed by either the federal or state government. This double citizenship creates no problems, because in any conflict between state and national law, national law comes first.

Under the terms of the 14th Amendment, children who are born in the United States while their parents are serving as diplomats of other countries do not automatically become citizens of the United States. This is because diplomats are not "subject to the jurisdiction" of the United States.

Under Legislative Acts. Congress has passed laws that state how citizenship will be granted according to *jus sanguinis*. The Immigration and Nationality Act of 1952 combined all laws on American citizenship, nationality, and immigration. This law provides that a person born outside the United States is an American citizen if both his parents are American citizens and if either one of them has established residence in the United States. He is also a citizen if one of his parents is a citizen who has lived in the United States for a certain length of time. The length of time depends on the nationality of his other parent. For example, if one parent is a citizen and the other parent is an American noncitizen national, the child is a citizen if his citizen parent has lived in the United States for at least one year before the child's birth. But if one parent is a citizen and the other parent is an alien, the citizen parent must have lived in the United States at least 10 years before the child's birth. Of the 10 years, 5 must have been after the parent reached the age of 14. A child who acquires citizenship at birth abroad in this last manner must live in the United States for a continuous period of five years between his 14th and 28th birthdays in order to keep his citizenship.

Court cases have determined that a person born of alien parents aboard an American vessel on the high seas is not entitled to American citizenship. But there is some question as to whether a child born on a ship of another country in American territorial waters acquires American citizenship by the rule of place of birth. Considerable evidence exists to show that an American citizen born in another country is considered "natural born" and eligible to be elected U.S. President. But an official ruling on this point has not yet been made.

THE OATH OF ALLEGIANCE

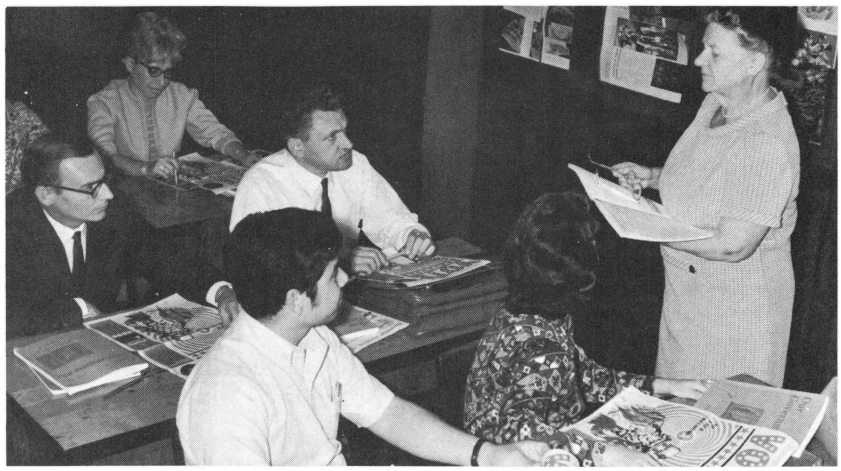
Every alien applying for American citizenship must, as the final step, take the following oath of allegiance to the United States:

"I hereby declare, on oath, that I absolutely and entirely renounce and abjure all allegiance and fidelity to any foreign prince, potentate, state, or sovereignty, of whom or which I have heretofore been a subject or citizen; that I will support and defend the Constitution and laws of the United States against all enemies, foreign and domestic; that I will bear true faith and allegiance to the same; that I will bear arms on behalf of the United States when required by the law; or that I will perform noncombatant service in the armed forces of the United States when required by the law; or that I will perform work of national importance under civilian direction when required by the law; and that I take this obligation freely without any mental reservation or purpose of evasion; so help me God."

Dual Citizenship

A person sometimes finds himself with two nationalities, because every country has its own citizenship laws. This situation is called *dual citizenship* or *dual nationality*. A person may have one nationality because of his place of birth, and another because of his parents' citizenship. For example, a child born in the United States of Italian parents may claim citizenship in both countries. At the same time, both countries can demand that the citizen fulfill his civic duties. In some cases, agreements between countries ban this kind of dual citizenship. A person might also gain dual citizenship as the result of naturalization. This situation may occur if the country he leaves does not recognize his change of allegiance, and still claims him as a citizen.

Persons who have dual citizenship are usually not aware of their unusual situations. Under international law, every nation is supreme within its own boundaries. For example, a child born in the United States of Italian parents is considered an American citizen within the borders of the United States. He is also considered an American while he travels with an American passport anywhere in the world except Italy. Italy has



James Malles, Chicago Board of Education

Citizenship Classes help people prepare to become citizens. Most adults seeking U.S. citizenship must pass a literacy test and show that they know something about the nation's history and government.

agreed not to claim such a dual citizen if he visits the country in time of peace. But it becomes difficult to determine his status if he remains in Italy for a long time, or if Italy becomes involved in a war while he is there. In the same way, it is difficult to decide the nationality of a naturalized citizen if the United States withdraws its protection from him because he returns to the land of his birth for an extended stay.

A person with dual citizenship faces another danger in time of war. If he fulfills his obligations of allegiance to one country, he may find that he is committing treason against the other.

Loss of Citizenship

Expatriation. Most countries recognize the right of any citizen to *expatriate* himself, or give up his allegiance to one country for allegiance to another. A person gives up his citizenship in one country when he is naturalized in another, if the country he leaves recognizes his right of expatriation.

The Immigration and Nationality Act of 1952 lists specific actions that may cause a person to lose his United States citizenship. Some of its provisions were designed to reduce the number of American citizens having dual citizenship. Other provisions were designed to expatriate American citizens for conduct that Congress considered improper for American citizens. However, the Supreme Court of the United States has declared some of these provisions unconstitutional.

A person can lose his U.S. citizenship if he voluntarily becomes naturalized in another country, voluntarily takes an oath of allegiance to another country, or serves in another country's military forces or its government. A person can also lose his citizenship by formally renouncing it, or by committing treason.

Statelessness. When a person is not the citizen or national of any country, he is *stateless*. If his homeland withdraws his citizenship as a punishment, he is not a citizen of any country. The same thing happens if he renounces his citizenship in one country, but does not acquire another nationality. A child could be born without being a citizen of any country if his alien parents come from a country that does not recognize the right of blood relationship, and if he is born in a country that does not recognize the right of place of birth. Under the laws of some countries, a person can become stateless as a result of marriage. A person whose homeland has been destroyed by another country may find himself in a similar situation. In the United States, a person who is not a citizen of any country is considered an alien. His legal position is worse than that of an alien, because he has no government to which he can appeal for protection. Many persons became stateless during World War II (see DISPLACED PERSON).

History

Ancient Times. The idea of citizenship goes back thousands of years. The city-states of ancient Greece had citizens, slaves or serfs, and aliens or noncitizens. Greek laws and traditions gave citizens many privileges, but also imposed heavy responsibilities. Citizens were expected to vote, to attend the assembly, to serve on juries, and to give military service. Slaves had few rights. Aliens had almost none, but they did have personal freedom and the protection of the law. See GREECE, ANCIENT (The People).

Some philosophers of ancient Greece, called *Stoics*, regarded all men as brothers (see STOIC PHILOSOPHY). They did much to promote the expansion of citizenship from the few to the many. Christianity, with its idea of the equality of man, also influenced the growth of the idea of citizenship. For years, Roman citizenship was a privilege highly regarded and eagerly sought. The Romans extended citizenship as their empire grew. See ROMAN EMPIRE (The People).

The Middle Ages. Citizenship declined with the fall of the Roman Empire and the rise of feudalism in Europe (see FEUDALISM; MIDDLE AGES). Millions of persons became serfs who owed service to the lords of the land. Each lord owed allegiance to a feudal lord above him, who in turn owed loyalty to the king. Under this system, there was little thought of citizenship.

Modern Times. As national governments grew in power, the people of each country began to owe allegiance to only one person, the king. With the spread of democracy, people usually transferred their allegiance from the king to the state. Citizens of kingdoms were usually called *subjects*. But as allegiance to a country began to replace allegiance to a king, the terms *citizen* and *national* gradually replaced the term *subject*.

CITIZENSHIP

In the United States, the Constitution did not define American citizenship precisely. The authors of the Constitution assumed that a citizen of one of the 13 original states would become a citizen of the United States without losing his state citizenship. Later, the United States followed British common law in accepting the rule of place of birth. In 1790, Congress adopted laws that also recognized the rule of blood relationship. These laws provided that children born of American citizens abroad were citizens of the United States, unless the father had never lived in the United States.

The rule of place of birth became a part of the Constitution when the 14th Amendment was adopted in 1868. The Supreme Court fully established the legality of this rule in a case decided in 1898. It held that Congress could not deny citizenship to any person born within the borders of the United States, regardless of the citizenship of his parents.

Most nations began to accept the idea of expatriation in the 1800's. Before that time, a person remained a citizen of the land of his birth, no matter where he lived. The United States has always tried to protect naturalized Americans against their nation of origin. It insists on a person's right to give up his former nationality in favor of a new one. But at the same time, American courts declared that American citizens owed permanent allegiance to the United States.

Congress in 1868 gave Americans the right of voluntary expatriation. This action followed a storm of protest against the British who punished American citizens of Irish descent for taking part in the Fenian rebellion. After the act of 1868, the federal government had to be consistent in its actions. It had to protect persons who sought naturalization in the United States. But it also had to allow American citizens the right to renounce their citizenship.

In 1907, Congress defined the acts that automatically lead to voluntary expatriation. The 1907 law was succeeded by the Nationality Act of 1940 which, in turn, was replaced by the Immigration and Nationality Act of 1952. The last two acts list in detail the grounds on which a U.S. citizen may lose his citizenship.

In 1963, Congress awarded an honorary citizenship for the first time. It was given to British statesman Sir Winston Churchill.

ROBERT RIENOW

Related Articles in WORLD BOOK include:

Alien	Democracy	Immigration and Emigration
Bill of Rights	Deportation	Nationality
Boys State	Freedom	Naturalization
Citizenship Day	Girls State	Patriotism
Civics	Government	Pledge to the Flag
Civil Rights	Human Relations	Voting
Community		

Outline

I. What Is Good Citizenship?
- A. Rights and Duties
- B. Education for Citizenship

II. How Citizenship Is Acquired
- A. Birth
- B. Naturalization

III. United States Citizenship
- A. Under the Constitution
- B. Under Legislative Acts
- C. The Oath of Allegiance

IV. Dual Citizenship

V. Loss of Citizenship

VI. History

Questions

What is a good citizen? What are his duties?

What actions could cause an American to lose his citizenship?

How do *civic rights* differ from *political rights?*

How is it possible for a citizen to be loyal and commit treason at the same time?

What are the two general methods by which a person acquires citizenship?

What status does a stateless person have in the United States?

What is the rule of *jus soli? Jus sanguinis?*

What is the origin of the word *citizenship?*

What is *citizenship education?*

What is a *noncitizen national?*

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CITIZENSHIP DAY is celebrated in the United States each year on September 17. The day honors native-born citizens who have reached voting age and naturalized foreign-born citizens. Citizenship Day ceremonies and celebrations include pageantry, music, and speeches to impress Americans with the privileges and responsibilities of citizenship.

A movement to recognize new citizens began in 1939. William Randolph Hearst gave it national prominence through his chain of daily newspapers. In 1940, Congress passed a resolution designating the third Sunday in May as *I Am an American Day.* It authorized the President to issue an annual proclamation urging its celebration.

On February 29, 1952, President Harry S. Truman signed a bill establishing September 17 as Citizenship Day. This act of Congress replaced I Am an American Day and moved the celebration to the date on which the United States Constitution was signed in 1787. Many cities continue to observe I Am an American Day in May.

RAYMOND HOYT JAHN

CITLALTÉPETL. See ORIZABA (mountain).

CITRANGE, *SIT rehnj*, is a hybrid plant derived from the sweet orange and the trifoliate orange. Although the fruit of the trifoliate orange is not eaten, the plants are hardier than ordinary oranges. Plant breeders developed the citrange to be raised in Georgia and in other regions of the South where the climate and soil do not allow oranges to grow. Commercial citrus plants have been grafted to the *rootstocks* (underground stems) of some types of citranges. The rootstocks provide a hardy, disease-resistant system for citrus plants. The citrange orange may grow from 2 to 3 inches (5 to 8 centimeters) in diameter. It has an acid, orangelike taste. It is used in cooking and to flavor various kinds of beverages. See also BREEDING (Plant). WILLIAM GRIERSON

CITRATE. See CITRIC ACID.

CITRIC ACID, *SIHT rik*, is a common organic acid that gives lemons, oranges, and other citrus fruits their sour taste. Lemon juice contains 6 to 7 per cent of the acid. The name *citric* comes from the Latin word *citrus*, which means *citron tree* (similar to lemon and lime trees). Carl Wilhelm Scheele, a Swedish chemist, first isolated citric acid from lemon juice in 1784.

Citric acid is used as a flavoring for soft drinks and pharmaceuticals. Industry uses it in chemicals, alkyd resins, and as a *mordant* (dye-fixative). It is also used to clean and polish steel, and to preserve color and flavor in canned and frozen fruits and fish. Citric acid is prepared commercially from fermentation of sugar, and by extraction from lemon juice, lime juice, and pineapple canning residues.

Pure citric acid forms colorless, odorless crystals that have a pleasant, sour taste. It is very soluble in water. Its chemical formula is $C_3H_4(OH)(COOH)_3$, and it melts at 153° C (307° F.). Citric acid combines with metals to form salts called *citrates*. JOHN E. LEFFLER

See also ACID; SCHEELE, CARL WILHELM.

CITRIC ACID CYCLE. See KREBS CYCLE.

CITRIN is a chemical substance that belongs to a group of chemicals called *flavonoids*. Scientists do not know exactly what citrin is, or if it is essential to man's health. But they have found that flavonoid substances help to control bleeding from the *capillaries* (the tiny blood vessels) in the body. Citrin, also called *vitamin P*, affects the capillary walls, making them less likely to hemorrhage. Citrin used in medicine is usually prepared from paprika and lemon peel. JOHN R. KOCH

CITRON is a large, usually sour fruit much like the lemon. It ranks among the largest citrus fruits. The citron tree grows wild in northeastern India. It is also grown commercially in Italy and the fruit is exported to other countries. The thorny citron tree has leaves that range from 4 to 7 inches (10 to 18 centimeters) in length, and have slightly toothed edges.

The fruit is 6 to 10 inches (15 to 25 centimeters) long, or longer, and shaped like an egg. It has a thick, firm *rind* (peel) that is preserved and candied for use in cakes, puddings, and candies. The rind also furnishes fragrant oils. The *etrog*, a variety of citron with small fruits, is grown for use in a Jewish ceremony called the Feast of the Tabernacles.

Scientific Classification. The citron belongs to the rue family, *Rutaceae*. It is classified as genus *Citrus*, species *C. medica*. WILLIAM GRIERSON

CITRONELLA is a pale yellow oil that is made from citronella grass. Citronella grass grows in China, Guatemala, Indonesia, Malaysia, Sri Lanka, Taiwan, and other countries. Its oil contains citronellal and geraniol. These two substances have different boiling points, and separate from citronella as the oil is distilled. Citronellal is used to make synthetic perfume ingredients. Geraniol smells like roses, and is used in many perfumes. PAUL Z. BEDOUKIAN

CITRUS is the name of a group of trees and shrubs which belong to the rue family. Some citrus fruits are the orange, grapefruit, lemon, mandarin, kumquat, tangerine, bitter orange, lime, citron, shaddock, and bergamot. Citrus trees grow wild in parts of India and southeastern Asia. The Chinese were the first to cultivate citrus trees, about 1000 B.C. These trees and shrubs have been grown in other parts of the world for their fruits for many years.

Citrus trees are thorny, but usually attractive. They are evergreen, with long, shiny, pointed leaves. The flowers are fragrant. Ripe citrus fruits are yellow to orange-red in color. All citrus fruits are a type of berry that scientists call a *hesperidium*.

Citrus fruits all grow in rather warm climates. They grow best where there is almost no frost or wind. All grow in tropical regions, but produce better fruit in a slightly cooler climate. Citrus plants grow best in Florida, Texas, California, and Arizona in the United States. Citrus fruits are grown in greater quantity than any other fruit in the United States. Citrus fruits are valuable foods. They contain large amounts of vitamins and minerals. Citrus fruits are usually high in vitamin C.

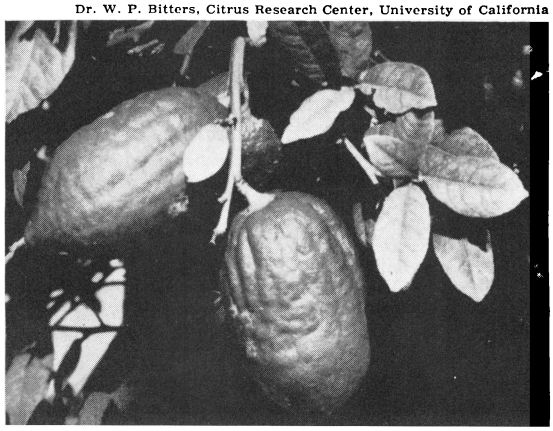
Scientific Classification. All citrus plants belong to the rue family, *Rutaceae*. These plants as a group make up the genus *Citrus*. WILLIAM GRIERSON

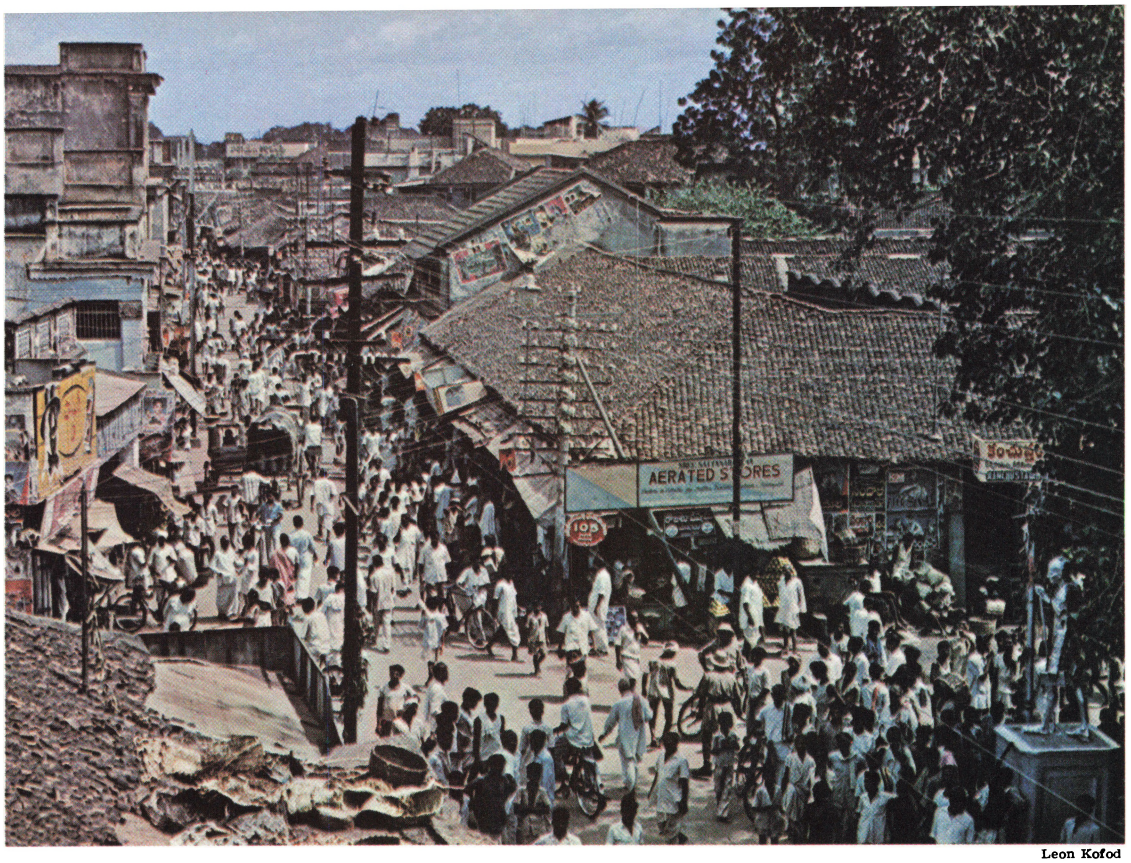
Related Articles in WORLD BOOK include:

Bergamot	Lemon	Tangelo
Citron	Lime	Tangerine
Grapefruit	Orange	Tangor
Kumquat		

The Citron Tree bears large sour fruit with a thick rind, *right*, that is often preserved and candied. The tree's thorny branches have long, slightly tooth-edged leaves, *below*.

Dr. W. P. Bitters, Citrus Research Center, University of California





Leon Kofod

Crowded Street Scenes—like this one in Rājahmundry, India—are common in cities throughout the world. Cities occupy only a small portion of the world's land. But more than a fourth of all people now live in or near cities, and the percentage continues to grow.

CITY

CITY is a community where thousands—or even millions—of people live and work. Cities are the world's most crowded places. New York City, for example, has an average of more than 21,600 persons per square mile (8,340 persons per square kilometer). The United States as a whole averages fewer than 60 persons per square mile (23 persons per square kilometer). Similarly, other large cities of the world have population densities hundreds or thousands of times as large as the average national population densities.

Most cities are overcrowded, dirty, and noisy—and sometimes unpeaceful. Traffic jams delay people who are trying to get to and from work, stores, or other places. Airplanes, automobiles, buses, trucks, electric power plants, factories, and other sources pollute the air with fumes that endanger people's health. Motor vehicles, factories, sirens, and building and wrecking machinery create noise that often becomes nerve-racking. Many cities have a high crime rate, and violence sometimes breaks out between racial, religious, and other groups. City people have also rioted to protest poor housing and other undesirable living conditions.

But despite all the drawbacks, the percentage of the world's people who live in *urban places* (cities and their surrounding areas) keeps growing. In 1800, only about $2\frac{1}{2}$ per cent of the world population lived in urban places of 20,000 or more persons. This figure had jumped to more than 25 per cent by 1970 and is expected to reach about 50 per cent by the year 2000. In 1800, the United States classified only about 5 per cent of its population as urban. This figure has reached about 73 per cent and is expected to reach about 85 per cent by 2000.

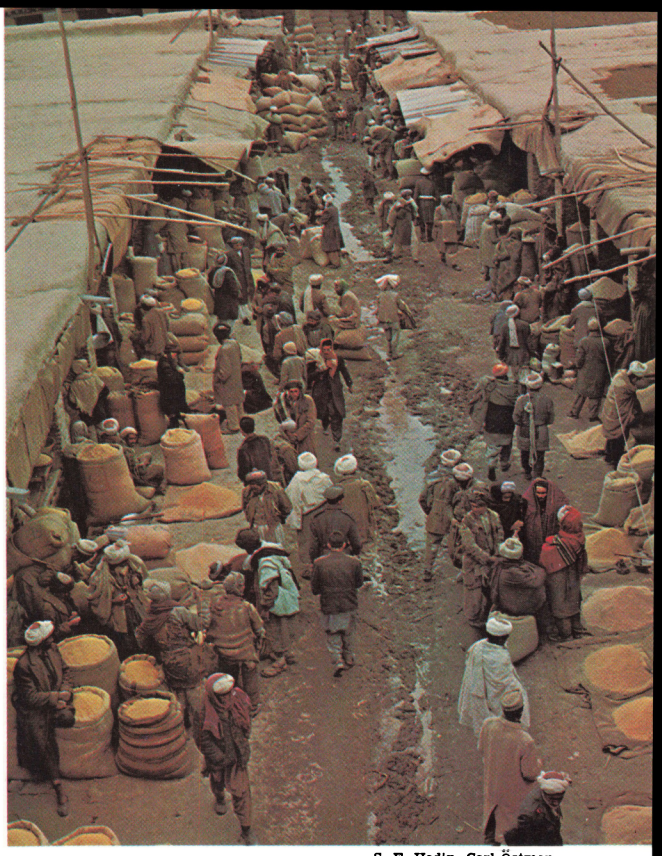
People choose to live in or near cities for several reasons. The main reason is the number and variety of jobs that are available. The economies of such nations as Canada, France, Germany, Great Britain, Japan, and the United States are based chiefly on manufacturing. Most manufacturing takes place in and near cities, and so most of the jobs are there. Far fewer jobs are available in the cities of developing nations, including most of the countries of Africa, Asia, and Latin America. Even so, large numbers of people flock to these cities. Many are farmers who no longer can earn a living from the land. They go to cities in search of jobs, but many cannot find work.

Cities also offer many more cultural and recreational activities than do rural areas. A city resident can go to art galleries, museums, and concerts. He can borrow books from huge public libraries and shop in stores that sell thousands of products. A city resident can also attend a variety of motion pictures, plays, and sports events.

Philip M. Hauser, the contributor of this article, is Professor of Sociology and Director of the Population Research Center at the University of Chicago and coeditor of The Study of Urbanization. *Reginald Malcolmson, Dean of the College of Architecture and Design at the University of Michigan, served as illustrations consultant for the article.*

J. Alex Langley, DPI

The Business Center of a city consists of closely packed tall buildings where people work and shop. In Tokyo, *above*, and other big cities, residential areas stretch far beyond the center.



S. E. Hedin, Carl Östman

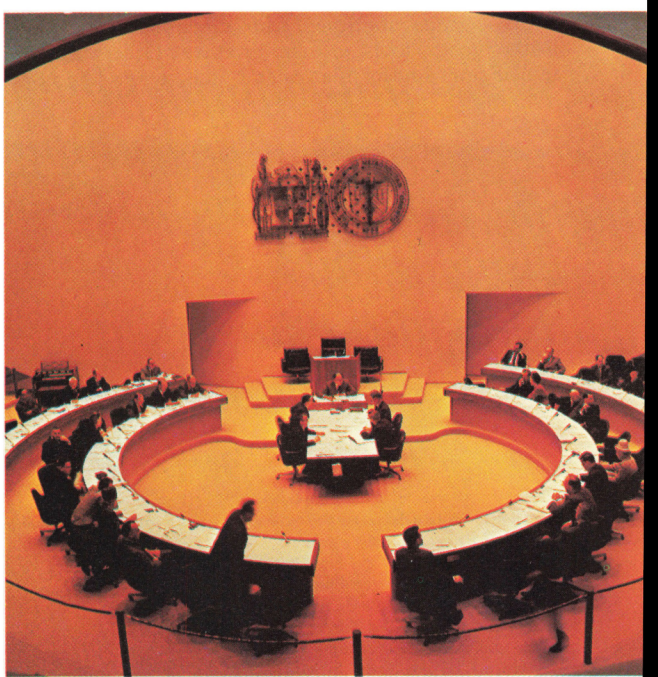
Trade and Industry provide jobs for millions of city dwellers throughout the world. An open-air grain market in Kabul, Afghanistan, *above*, helps make that city an important trading center.

Large numbers of people choose to live in or near a city simply because they like the rapid pace of city life. Perhaps these same people complain bitterly about the crowds, dirt, and noise they experience in a city. But they like the bustling activity that makes city life so different from rural life.

There is no standard that tells how many people a community must have to be classified as a city. In fact, some communities are called cities for reasons that have nothing to do with their population. In the United States, for example, one definition of *city* is any community—regardless of population—that has some form of city government. But most people use the word for large urban communities. This article uses the word *city* in that sense.

There are population standards for distinguishing urban places and rural places. In general, all communities in the United States with 2,500 or more persons, and smaller communities near big ones, are considered urban. Farms, and communities in uncrowded areas with fewer than 2,500 persons, are considered rural. The standard for distinguishing urban and rural places varies among the nations of the world, ranging from about 2,500 to 10,000 population. The United Nations considers as urban only those communities that have a population of 20,000 or more.

This article tells how cities began and developed. It describes cities and city life throughout history. It also discusses the problems of today's cities and takes a look at cities of the future.



Hal Barkley, Miller Services

City Governments must provide such services as fire fighting and sewage disposal for thousands or even millions of people. Toronto legislators meet in the City Hall Council chamber, *above*.

Man has probably lived on the earth about 2½ million years. But he began to live in permanent settlements only about 10,000 years ago. Men who established these settlements are called New Stone Age, or *Neolithic*, people. Before that time, people wandered from place to place to hunt animals and gather plants for food. Neolithic people were the first farmers. As farmers, they no longer had to wander to find food and they began to settle in villages.

By about 3500 B.C., a number of Neolithic villages had developed into small cities. Ever since the first city appeared, many peoples have founded many cities in many places—and for many reasons. These cities have differed in size and layout, and they have had a variety of economic, governmental, and social systems. But all permanent settlements—from Neolithic village to giant city—needed four main features to begin and to grow. These features were (1) advances in technology, (2) a favorable physical environment, (3) social organization, and (4) population growth.

Advances in Technology. The word *technology* refers to the discoveries and inventions that help people change and improve their way of life. The development of farming skills was the technological advance that led to the founding of cities.

Neolithic men learned how to grow crops and invented tools that improved farming methods. They also domesticated animals, which they used to do work and as a source of food. All these developments helped many Neolithic men produce more food than they and their families needed. Because of this surplus food, a number of people switched to jobs other than farming. Some became craftsmen who made baskets, cloth, leather goods, tools, or other products. Others became miners and dug for flint, metal, and stone. The nonfarmworkers got their food by trading the things they made to the farmers for surplus crops. Through the years, technological advances in agriculture enabled more people to become nonfarmworkers. These people founded and populated the cities of the world.

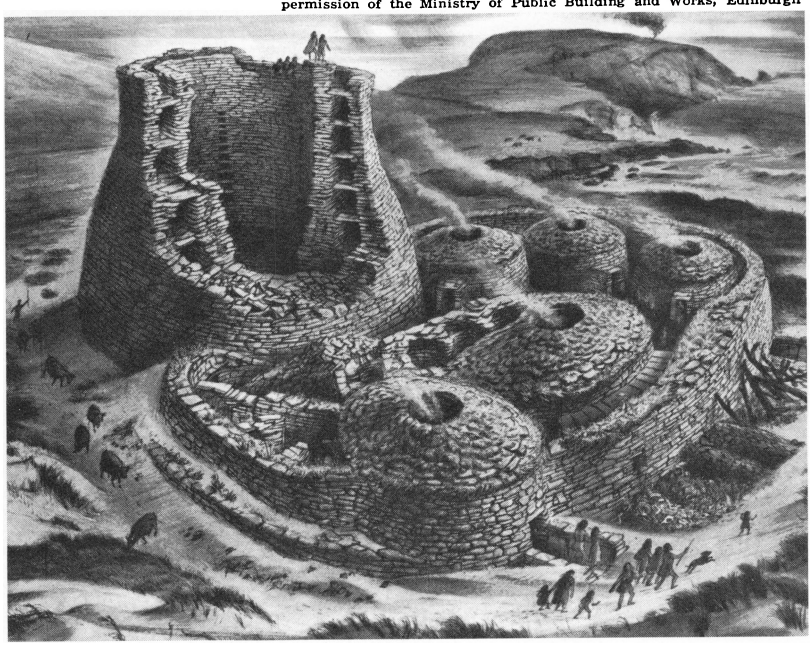
Technological advances have influenced city life throughout history. For example, the development of the steam engine in the 1700's gave man the power source he needed for large-scale manufacturing. Many cities became giant manufacturing centers partly because of this development. Sometimes industrial expansion led to new cities. In the early 1900's, the United States Steel Corporation planned and built Gary, Ind., around its new mills. During the 1900's, thousands of suburbs grew up around big cities. The automobile and the railroad train—two technological advances in transportation—helped make these suburbs possible. People who lived there needed cars and trains to get to and from work in the cities.

Physical Environment of a city includes its location and climate and the availability of water and food. Cities have been founded in many kinds of environments, but their development has depended on certain favorable environmental features. All cities must have enough drinking water. Early communities, which depended on farming, needed enough rainfall to grow crops. Good soil was also essential for growing crops, and nearness to other food—animals and edible plants—was helpful. Other favorable environmental features included a reasonably mild climate and a location near materials that could be used for clothing and shelter.

Early peoples found many favorable environmental features in river valleys in subtropical climates. Some of the earliest villages and cities lay in the Tigris-

The University Museum, University of Pennsylvania

Drawing by Alan Scorell, British Crown Copyright; reproduced by permission of the Ministry of Public Building and Works, Edinburgh



Neolithic Villages were the ancestors of cities. An artist's conception, *right*, shows how the Neolithic village of Jarlshof in the Shetland Islands may have looked. A protective wall surrounded the houses and a tall watchtower. Many people stored surplus food in large jars. A painted storage jar, *above*, was found in Pakistan's Indus Valley. It stands about 2½ feet (76 centimeters) high.

Euphrates Valley in the Middle East, the Nile Valley in Egypt, the Hwang Ho (Yellow River) Valley in China, and the Indus Valley in India and Pakistan. See WORLD, HISTORY OF (Cradles of Civilization).

Through the years, other environmental features have also helped cities develop. Since ancient times, for example, men have traveled in ships to trade with men of other nations. Many cities that lay near large bodies of water became important trading centers. They included Istanbul, Turkey; London, England; Shanghai, China; and Venice, Italy. Chicago, in the United States, and Toronto, in Canada, developed partly because they lay along important land and water transportation routes. Many cities, including Manchester, England, gained importance as manufacturing centers because of nearby minerals or other raw materials needed for manufacturing. Some cities owe their development chiefly to climate. The warm, healthful climate of parts of Florida and the southwestern United States attracted many people.

Social Organization. Certain rules of behavior are needed to maintain order, peace, and security in any community. Since Neolithic times, most people have agreed that it is wrong to harm or steal from others in their group. In turn, people expect that their own rights to safety and property will be respected. People also have duties toward their group as a whole. For example, men have often fought to protect their group from enemies.

The maintenance of order in groups also requires some system of authority. In the family, the most basic social group, parents have authority over their children. In larger social groups, including cities, citizens must accept the authority of government.

Neolithic villages had a simple social organization. People were required to respect each other's rights, and children had to obey their parents. But most villages had few government officials as we think of such officials today. Someone probably took care of the surplus food, and there may have been a chief planner for defense against outsiders. As cities grew, the duties of family members and neighbors toward each other remained basically the same. But to keep order in cities, governments took on a greater role in managing community affairs and providing services for the people. The number of government officials and workers also increased greatly. Today, many cities need thousands of government workers, including mayors, city planners, clerical employees, councilmen, firemen, garbage collectors, health officials, policemen, and teachers.

Population Growth. Only about 10 million persons existed during the Neolithic Period. The world's population reached about 500 million by A.D. 1650 and more than $3\frac{1}{2}$ billion by 1970. This *population explosion* led to an increase in both the size and number of cities.

Two other trends also have aided the development of cities. One trend—sometimes called the *population implosion* or *population urbanization*—is the ever-increasing concentration of people in small parts of the earth. These parts are the cities and their surrounding areas. The other trend—sometimes called the *population displosion* or *population diversification*—is the movement to cities by persons of a variety of cultural backgrounds. Through the years, cities came to include people of different racial, religious, national, and language groups. This mixing of people brought about *cultural diffusion*, a process by which people of different backgrounds learn from each other by exchanging ideas. Cultural diffusion ranks among the most important factors in the development of civilization.

CITY/*Ancient Cities*

Hundreds of years passed before the Neolithic villages developed into cities. The first cities appeared about 3500 B.C. in the Tigris-Euphrates Valley of Sumer in the lower part of Mesopotamia (now Iraq). Egyptian villages in the Nile Valley developed into cities about 3000 B.C., and villages in the Indus Valley became cities about 2500 B.C. The first Chinese cities began about 1500 B.C. Indian villages in Central America developed into the first cities of the Western Hemisphere about 200 B.C.

Ancient cities differed from Neolithic villages in several ways. The cities were bigger than the villages and they had large public buildings, including temples for worship and places for storing grain and keeping weapons.

The cities had more people than the villages and, unlike the villages, they attracted people from a variety of backgrounds. The work of the city people also differed. Almost all village workers were farmers. Some city people farmed land outside the cities, but most of them had nonfarm jobs. Craftsmen and government workers became numerous in the early cities, and a new group of workers—the *merchants*—appeared.

Description. An early ancient city covered less than 1 square mile (2.6 square kilometers). Most of its people lived near the city's water supply because they had to get their own water and carry it home themselves. Technological advances—including aqueducts for transporting water long distances—enabled some ancient cities to grow. Rome grew to a size of more than 4 square miles (10 square kilometers) after it developed an outstanding system of aqueducts.

Many ancient cities had walls surrounding them for protection against enemies. Hills also helped protect some ancient cities. Rome lay on hills, and Athens was built around a hill where the people could go in case of attack. The central area of most cities included a place of worship, the ruler's palace, and a food storehouse. In some cities, this central area was walled off to keep out both enemies and hungry citizens. Houses stood crowded together around the area.

Sanitation presented a major problem in ancient cities, most of which had no system for getting rid of wastes. The people simply threw garbage and other wastes into the streets or piled them up outside the city wall. As a result, disease spread quickly and death

THE GROWTH OF PARIS

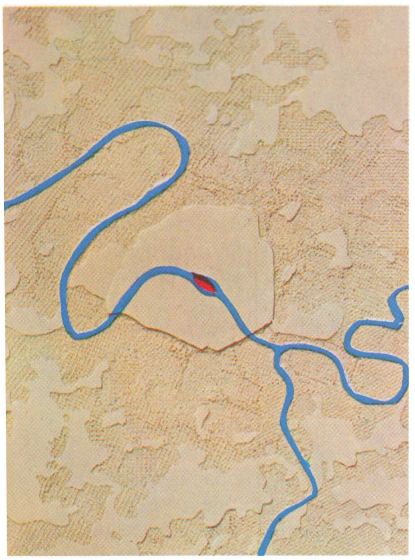
These two pages show the growth of Paris from a small settlement into one of the world's largest metropolitan areas. Paris is a good example of the development pattern of many of the world's cities.

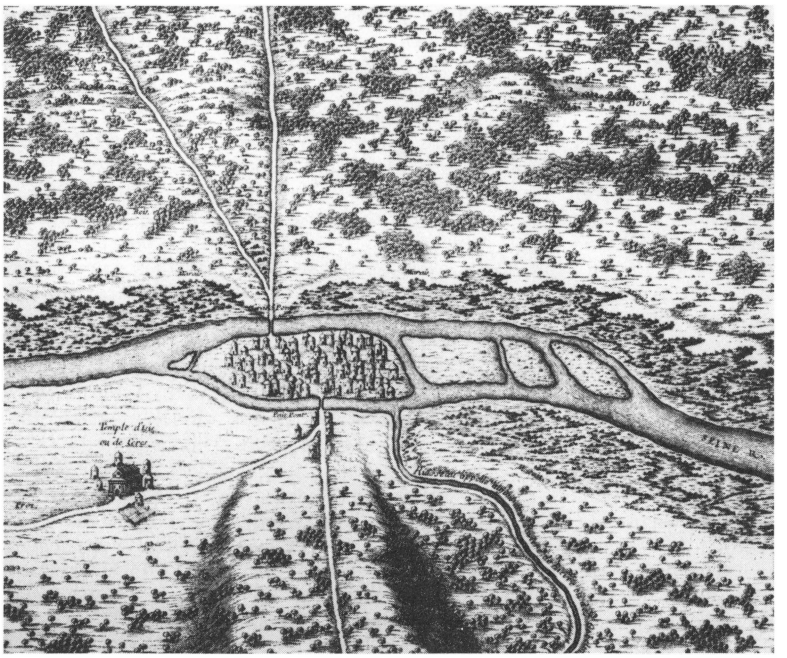
ANCIENT PARIS

(Paris in 52 B.C.)

Area: About 100 acres (40 hectares)

Population figure not available





Detail of an engraved map (1705) by A. Coquart; Newberry Library, Chicago

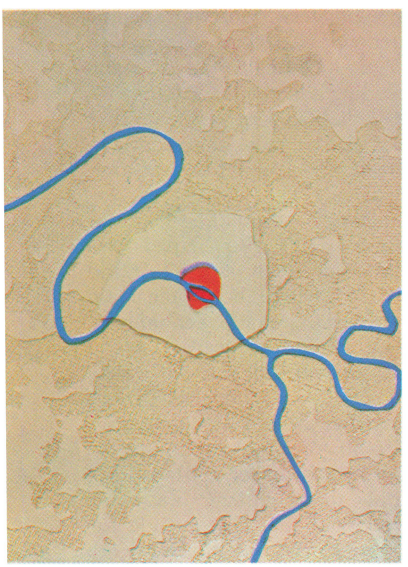
Ancient Paris, shown in red on the color map, was a settlement on an island in the Seine River, *above*. The Romans took over the settlement from a Celtic tribe in 52 B.C. Paris soon spread out on both banks of the Seine.

MEDIEVAL PARIS

(Paris in the late A.D. 1400's)

Area: About 3 square miles (8 square kilometers)

Estimated Population: 150,000



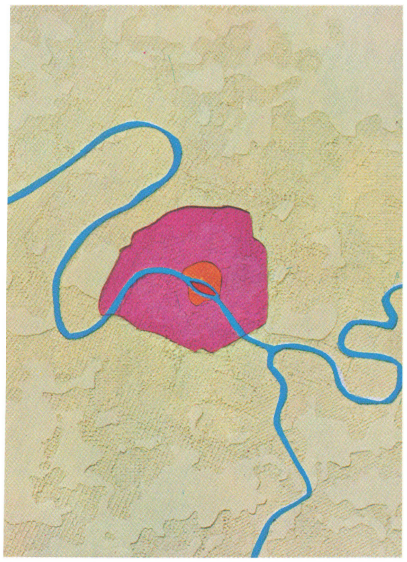
Engraved map (1573) by Franz Hohenberg; Newberry Library, Chicago

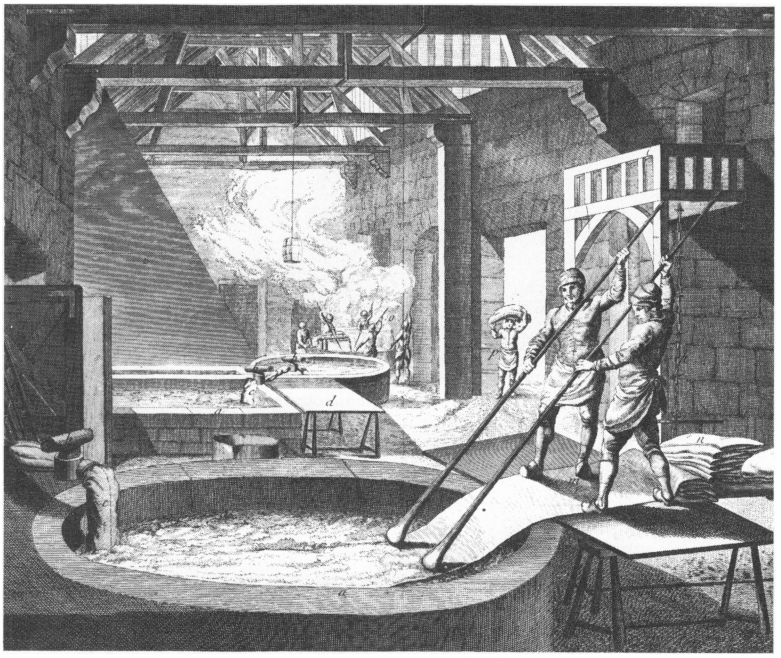
During the Middle Ages, Paris expanded to include the orange area on the color map. Walls surrounded the city and the Seine River divided it, *above*. The walls made further expansion difficult, and the city became overcrowded.

INDUSTRIAL PARIS
(Paris in 1841)

Area: About 30 square miles (78 square kilometers)

Population: 912,033





Detail from an engraving by Renard from Denis Diderot's *Encyclopedia* (1771); Newberry Library, Chicago

Industrial Paris grew to about 10 times the size of medieval Paris. Factories sprang up in the new parts of the city, shown in rose on the color map. Many people left the farms to take jobs in such factories as the Gobelin dye works, above.

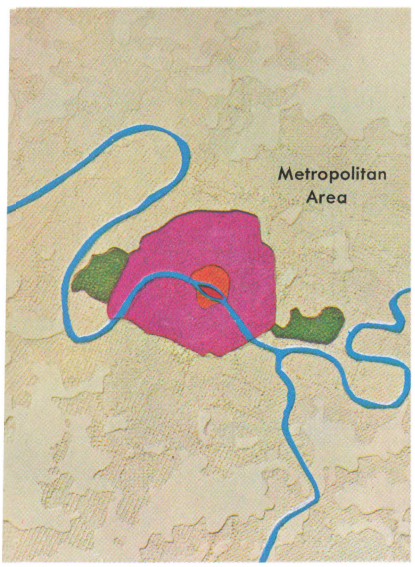
PARIS TODAY

Area: 41 square miles (106 square kilometers)

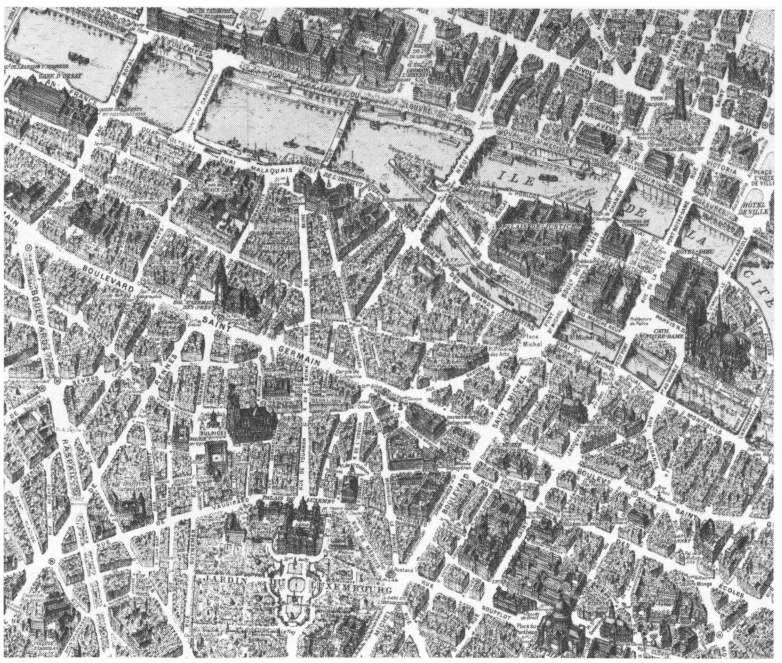
Population: 2,590,771

Metropolitan Area: 185 square miles (479 square kilometers)

Metropolitan Area Population: 8,196,746

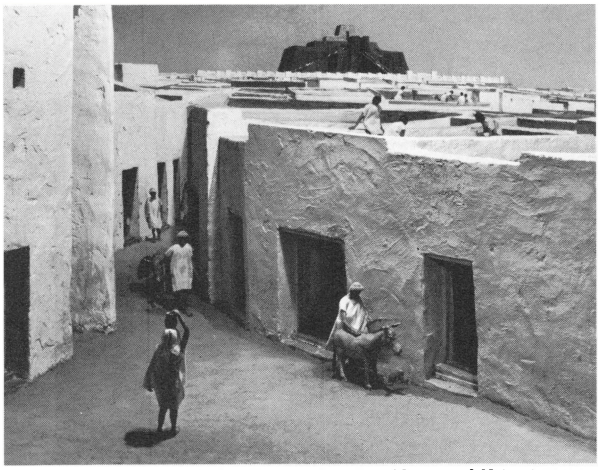


WORLD BOOK illustrations by George Suyeoka

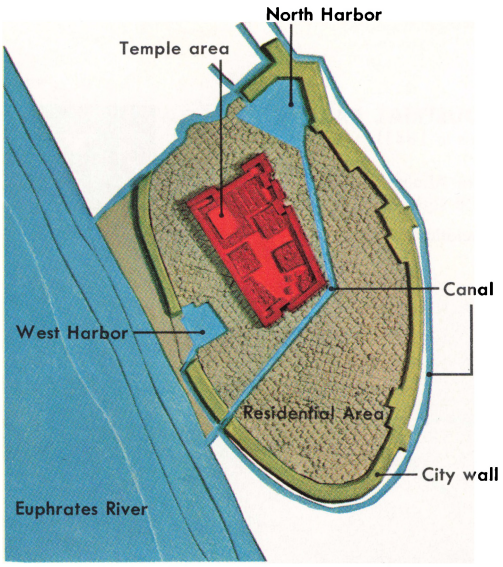


© Blondel La Rougery Map (French and European Publications, New York City)

Paris Today. Since the 1800's, the city limits have expanded slightly to include the dark green areas on the color map. The city and its suburbs now form a metropolitan area about six times the size of industrial Paris. Central Paris, with its boulevards, is shown above.

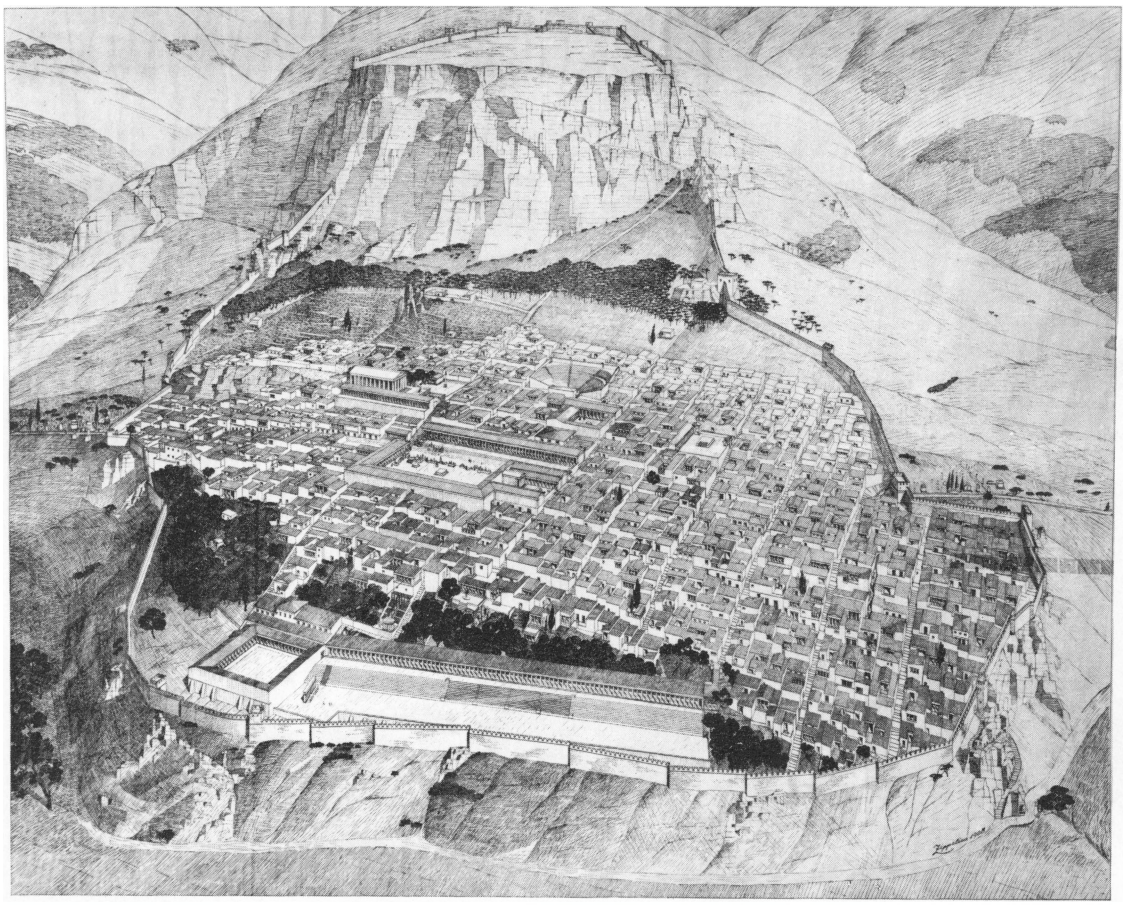


Detail of a diorama; American Museum of Natural History



WORLD BOOK illustration by George Suyeoka

Ur Was One of the First Cities. The Sumerians founded it about 3500 B.C. in what is now Iraq. They built a *ziggurat* (temple), *background above,* in the shape of a mountain—perhaps because they once worshiped on mountaintops. The plan of Ur is shown at the right.



Drawing (1908) by A. Zippelius; Deutsches Archäologisches Institut, Istanbul

Priene, an Ancient Greek City, lay in what is now western Turkey. The wall around the city helped keep invaders out. The market place, consisting of long, narrow buildings and a large yard, dominated the center of Priene. Government buildings, houses of worship, and an outdoor theater stood nearby. A huge gymnasium and a stadium stood along the near wall. The houses, as in many cities today, were laid out in rectangular blocks.

rates were high. The narrow, unpaved streets often turned into seas of mud when rain fell.

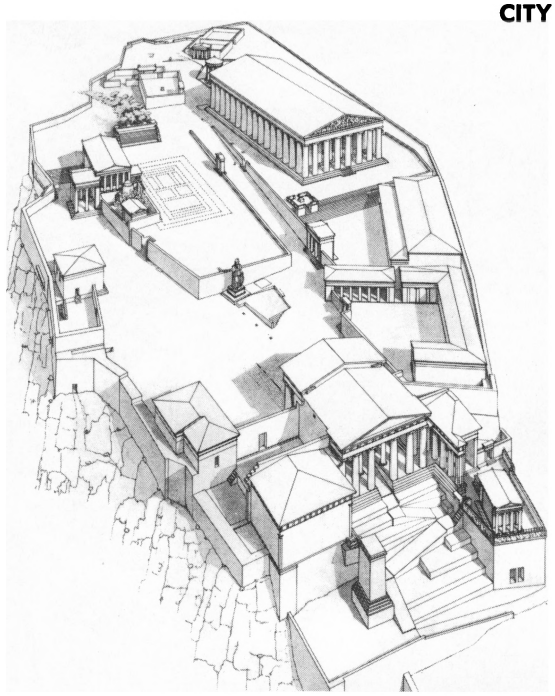
Some ancient cities reached a more advanced degree of development. Rome, for example, had a sewer system, a water supply system, and many huge public structures, including public bathhouses. Other advanced ancient cities included Athens, Babylon, and several cities of Egypt. See ATHENS; GREECE, ANCIENT (illustration: The Center of Athenian Life); BABYLON; EGYPT, ANCIENT; JERUSALEM (illustration: Jerusalem at the Time of Jesus Christ); ROME (The Ancient City).

The People. Ancient cities had more people than did Neolithic villages, but far fewer than cities of today. Most of the cities had populations of under 10,000, though Athens, Peking, and Rome each had more than 100,000 persons.

The first peoples of the first cities formed *homogeneous societies*. That is, they had the same racial and geographic backgrounds and shared the same religious beliefs and other cultural characteristics. But the cities soon began to draw people from a variety of backgrounds. Many people moved from the countryside in search of a better life in a city. Others had been captured in war and were brought to cities as slaves. The arrival of newcomers gave the cities *heterogeneous societies*, made up of people of many backgrounds.

The formation of heterogeneous societies caused cultural diffusion, but it also had undesirable effects. In many cities, the original group and the newcomers distrusted each other. Various forms of prejudice and discrimination developed.

The people of ancient cities were divided into classes. The upper class included rulers, government and military officials, and high priests. The lower class consisted of farmers, craftsmen, and merchants. At the very bottom of society were the newcomers, especially slaves and people from greatly different backgrounds

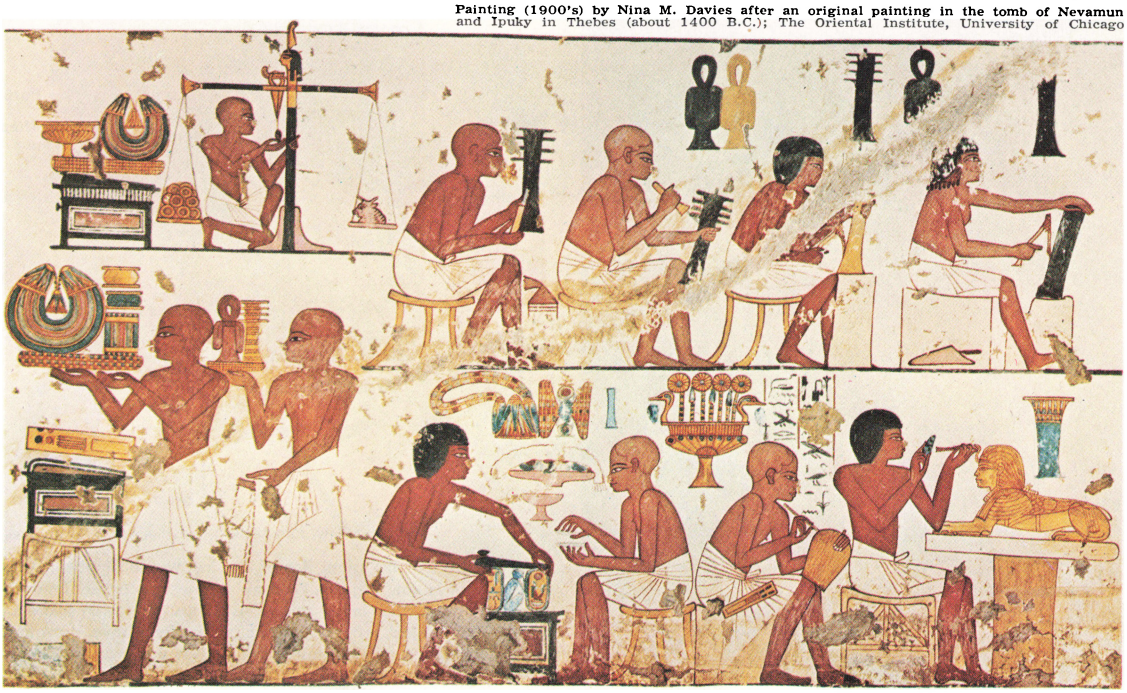


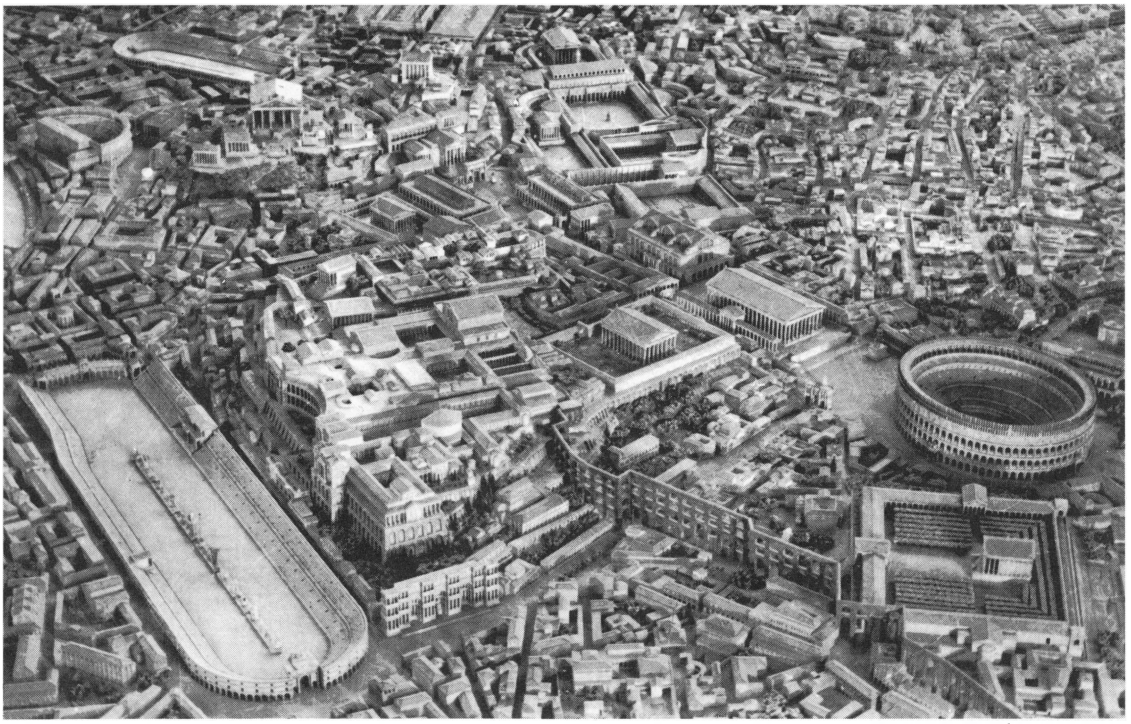
Drawing (1941) by G. P. Stevens; American School of Classical Studies at Athens

The Acropolis, a hill in the center of Athens, served the ancient Athenians in two ways. The people retreated to the walled-in hilltop when Athens was attacked. They also worshiped in the temples, including the famous Parthenon, *upper right*.

Ancient Craftsmen had an important role in city life. They made products that the people needed and wanted, including items for everyday use and works of art. The painting below shows Egyptian craftsmen making jewelry, vases, and other goods.

Painting (1900's) by Nina M. Davies after an original painting in the tomb of Nevamun and Ipuky in Thebes (about 1400 B.C.); The Oriental Institute, University of Chicago

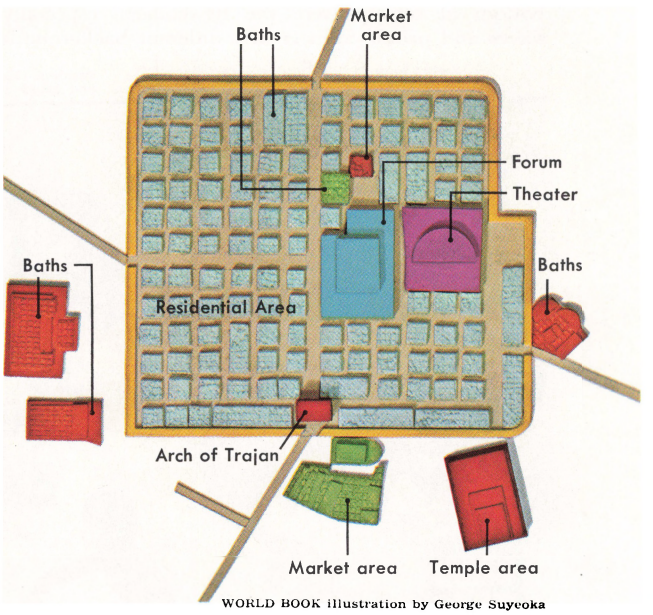




Museo della Civiltá Romano, Rome

Rome, One of the Largest Ancient Cities, reached a size of more than 4 square miles (10 square kilometers) and a population of over 100,000. Aqueducts carried water from mountain springs. One of these long wall-like structures appears at the lower right of the model of Rome above. Rome was famous for its huge public buildings. These included the oblong Circus Maximus, *left,* and the circular Colosseum, *right,* where people were entertained, and many government buildings.

Brian Brake, Rapho Guillumette



WORLD BOOK illustration by George Suyeoka

Timgad, part of the giant Roman Empire, was built about A.D. 100 in what is now Algeria. Military engineers planned Timgad and many other cities in the empire as camps for Roman soldiers. The ruins of Timgad, *left,* and a plan of the city, *above,* show the orderly arrangement of buildings and streets that was typical of the work of these military men.

than the native citizens. The newcomers were called *outcasts*, and most of them were forced to live in separate sections of the cities. They had the poorest housing, little food and clothing, and no education.

Upper-class families lived in large houses. Most other people lived in small one- or two-room houses. In many families of all classes, children, parents, grandparents, and other relatives lived in the same house.

In most ancient cities, only boys from upper-class families received a formal education. Other boys learned the trade of a craftsman—usually that of their father—or received no education at all. Girls of all classes learned household duties from their mothers.

Most people worshiped a number of gods. Many thought that angry gods caused personal misfortune. Festivals were held to honor and to please the gods. Many ancient peoples, including the Egyptians, Greeks, and Romans, built beautiful temples and monuments and dedicated them to the gods. Some Indians of Central and South America also followed this practice. For example, ancient Indians constructed the famous religious buildings at Teotihuacán, near Mexico City.

Economy. Just as technological progress in agriculture had made Neolithic villages possible, further advances in farming spurred the development of ancient cities. The invention of new farm tools and the discovery of new methods of cultivation, irrigation, and animal raising helped increase food surpluses. As the surpluses increased, more and more people stopped farming and went to cities in search of other work.

Craftsmen became an important group in the cities. The first craftsmen wandered from place to place because no one community had enough work for them. But as cities grew large enough to support them, craftsmen began settling permanently.

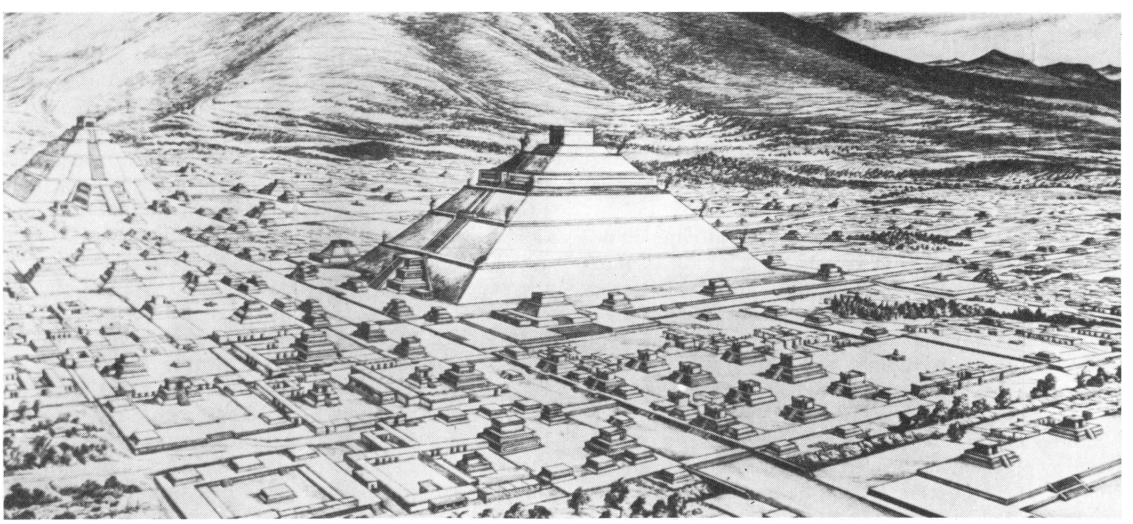
The first craftsmen sold the products they made. Later, city life grew more complex and a new group of working people, the merchants, appeared. This group sold the products made by others.

The merchant class was a result of technological advances in transportation. The wheel, invented in the Tigris-Euphrates Valley about 3500 B.C., gradually came into general use during ancient times. Wheeled vehicles and vastly improved roads allowed men to move large amounts of goods within cities and from city to city to be traded. Improvements in water transportation enabled merchants to trade their goods both in nearby places and in distant lands. Foreign trade became important to the economy of some ancient cities. The Phoenicians played a leading part in the development of trade over large bodies of water.

Government. Religious leaders performed most duties of government in the earliest communities. The people believed that their leaders' authority came from the gods. Therefore, the leaders were responsible to the gods, not to the people. As communities developed, emperors, kings, and other nonreligious rulers took over the power to govern. These rulers developed laws that could be enforced by military and police power. But many people still believed that the right to govern came from the gods. As a result, rulers had both the divine right to rule and the civil power to enforce laws.

Local administrators governed most ancient cities. They were responsible to the emperor, the king, or some other higher authority. Some cities, including Athens, were independent of any higher authority. Their rulers governed the city and its outlying area. Such regions were called *city-states* (see CITY-STATE).

The upper class ran the governments of ancient cities. They taxed the craftsmen, farmers, and merchants heavily to pay the costs of operating the government, constructing public buildings, and carrying out other projects. The people had little or no voice in the government. Athens and some other Greek city-states were important exceptions. In those communities, all adult males who were not slaves helped decide government policy. See DEMOCRACY (Origins of Democracy).



Drawing by Feliciano Peña; Instituto Nacional de Antropologia E Historia, Mexico City

Teotihuacán, *above,* was a religious center near what is now Mexico City. It flourished from about 600 B.C. to about A.D. 900. Although not a true city, it marked a step in the development of urban living in North America. The Pyramid of the Sun, *center,* covers over 10 acres (4 hectares).

Etching (1600's) by an unknown artist; Bibliothèque Nationale, Paris

Medieval Europe had many small, walled cities. Magnificent churches towered above the other buildings, symbolizing medieval society's emphasis on religion. The Cathedral of Notre Dame in Reims, France—marked with an "A" above—ranked among the biggest and most beautiful medieval buildings.

CITY/*Medieval Cities*

The Middle Ages began after the fall of the Roman Empire in A.D. 476 and lasted until about 1500. The Roman Empire ruled a vast region that, at its height, included most of Europe, the Middle East, and the northern coastal area of Africa. Rome was its capital.

The Romans helped build cities throughout their empire. They also built a network of roads that served as trade routes between the cities. The empire declined during the 400's, and Germanic tribes conquered it and divided it into many kingdoms. These tribesmen were warriors, hunters, and farmers who had little interest in trade. After the fall of the Roman Empire, trade among European cities almost stopped. Thousands of people left the cities and went to work on farms. Between the 400's and 1000's, the populations of existing cities decreased and few new cities appeared. Trade regained importance after about 1000, and cities began to grow again.

Description. Many European medieval cities had a similar layout. A typical city covered less than 1 square mile (2.6 square kilometers) and had walls around it for protection against invaders. The city's main church—in many cases a magnificent, towering Gothic cathedral —stood in the central area. The church was the city's biggest and most expensive building and a symbol of medieval emphasis on religion. The chief government buildings and the market place were near the church. Wealthy people lived near the center of the city and the poor lived away from this area. Some poor people even lived in huts outside the walls.

Some medieval cities, like ancient cities, were dirty and unhealthful. Disease spread rapidly, partly because the people had no sanitary method for getting rid of garbage and other wastes. From time to time, disease wiped out a large part of a city's population.

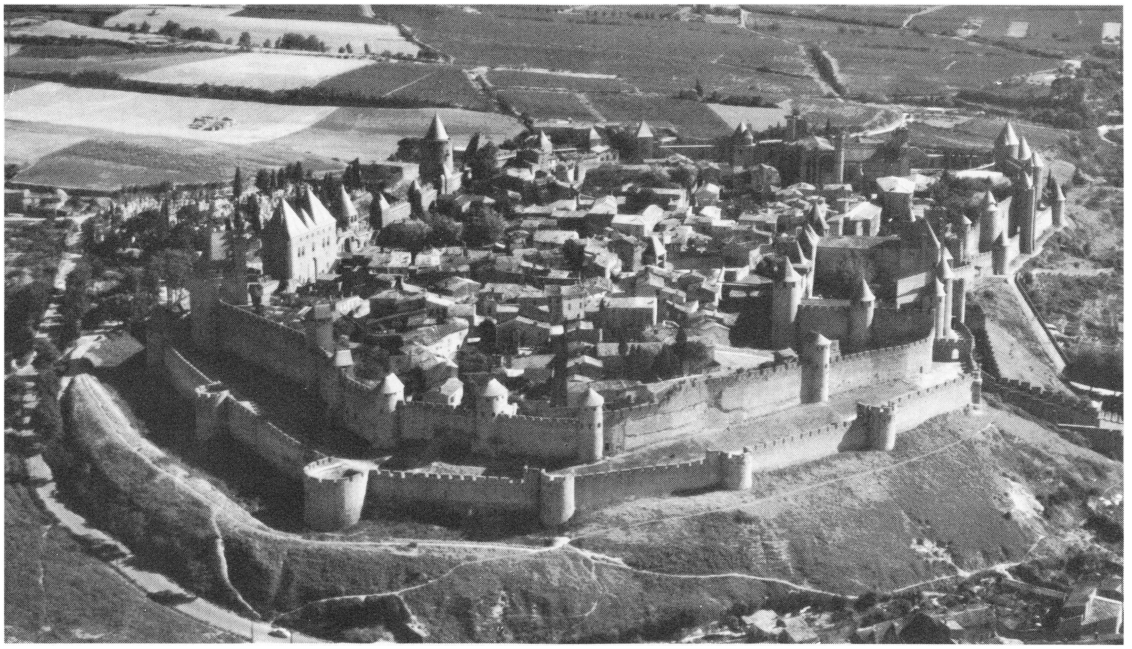
The walls around medieval cities limited the amount of living space. Land was expensive, so people began putting up five- and six-story buildings. Overcrowding became a problem during the late Middle Ages. Some cities solved this problem by knocking down the walls and rebuilding them farther out. Florence, in Italy, increased its size three times in this way. Other cities let their walls stand but built new cities nearby.

Scholars believe that Eastern medieval cities had the same general pattern as European cities. But Eastern trade did not decline, and many Eastern cities were large and prosperous throughout the Middle Ages.

The People. Many medieval cities were small settlements with only 300 or 400 people. Even Lübeck, Germany, one of the most important cities in northern Europe, had a population of only about 10,000. London, with about 40,000 people, Venice, with about 100,000, and Paris, with about 150,000, ranked among the biggest cities in medieval Europe. Many Oriental cities probably had larger populations.

European medieval cities attracted people from a variety of backgrounds. But the people tended to settle in *quarters* (neighborhoods) with people of their own group. Some quarters resembled separate cities. They had their own markets, churches, water supplies, and other facilities. A person almost always stayed in his own neighborhood. The system of separate quarters helped limit conflicts between the people of the various groups, but it also limited the exchange of ideas.

Upper-class medieval people lived in large houses that had separate rooms for bathing, cooking, eating,



Photothèque Française

Carcassonne, France, shows how medieval city dwellers sought protection from invaders. More heavily fortified than most cities, Carcassonne was surrounded by two walls. Defenders could fight off invaders from towers and a castle located along the walls. The castle, *right,* also had a wall around it. Only two gates led into the city, and they were heavily guarded.

Illustration from an illuminated Latin manuscript by an unknown artist (1300's); Bibliothèque Nationale, Paris

Trade Fairs were held each year in many European cities during the Middle Ages. Merchants traveled from fair to fair, buying and selling goods and exchanging ideas about new products and production methods. In the scene at the right, a bishop blesses a trade fair while merchants discuss prices and a man on horseback prepares to amuse fairgoers with acrobatic tricks. Trade fairs became part of the general revival of trade that spread through Europe after about 1000. This revival helped cities prosper and grow. Most European cities had lost importance and stopped growing after the Roman Empire fell and trade almost stopped in the late 400's.

Illustration from an illuminated manuscript (1500's) by an unknown Flemish artist; The Bodleian Library, Oxford, England

Cities in Flanders—including Bruges, *left*, and Ghent, Liège, and Ypres—grew prosperous from trade during the Middle Ages. Flemish merchants shipped large quantities of wool across the North Sea to England. They also carried on a heavy overland trade in France, Germany, and other countries. Flanders was sometimes called the market place of Europe.

sleeping, and religious and social activities. The idea of different rooms for different activities also began to appear among the middle and lower classes. But most of these people continued to live in apartments or houses with one or two rooms that were used for all purposes. Some public institutions developed that gave the people the benefits of specialized use of space. These institutions included public bakeries, bathhouses, and hospitals. But few people in a medieval city had much comfort or privacy.

During the Middle Ages, children, parents, grandparents, and other relatives continued to live in the same house. Some medieval households also included servants and workers associated with the family's economic activity. For example, some young men of the upper class worked as personal servants to noblemen and lived in the noblemen's houses. Many *apprentices* (young men learning a craft) lived in the homes of the craftsmen who taught them.

As in ancient times, formal education was largely restricted to boys of the upper class. In Europe, the Christian church played an important part in medieval education and ran most of the schools. Priests taught in these schools and also in many schools that were run by governments.

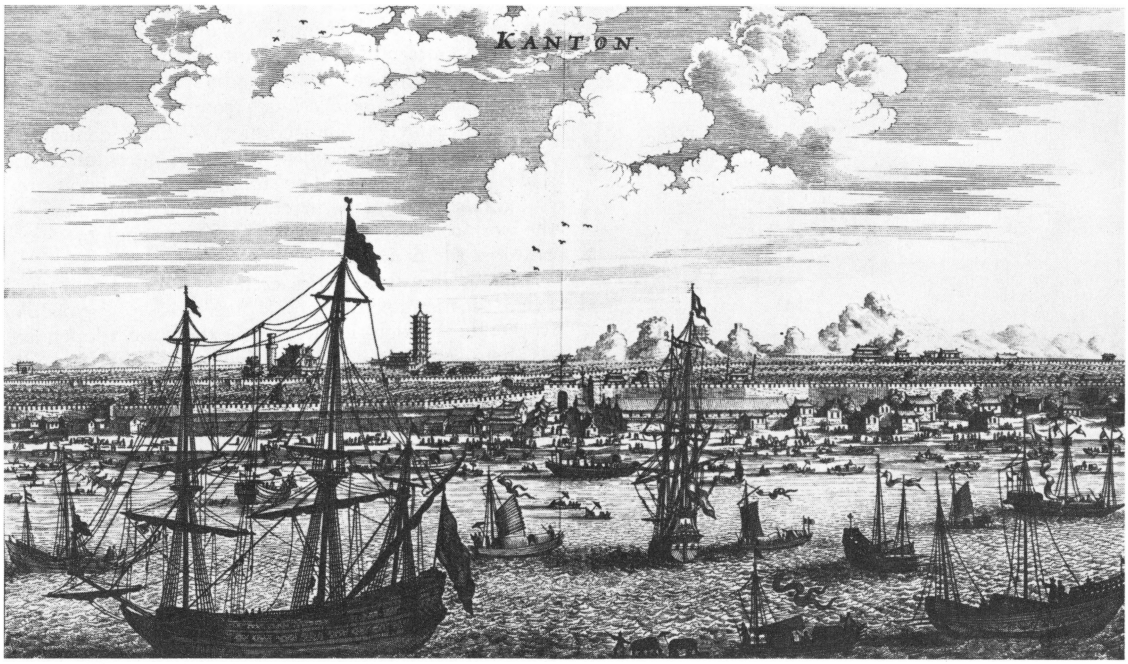
Religion played a vital role in medieval life. Major religions included Christianity in Europe, Islam in the Middle East, and Buddhism and Hinduism in the East.

In Europe, the Christian church had great influence. Church officials owned much land and could tax the people. The church also performed such important activities as baptism, marriage, and burial services. The church could ban people from religious services through its power of *excommunication*. An excommunicated person was a public disgrace. In addition, people who did not belong to the Christian church were often treated harshly. For example, Jews in the Christian cities of medieval Europe suffered much persecution.

Economy. During the Middle Ages, much land in Europe was divided into large rural estates called *manors*. Lords and bishops owned most of the land, and peasants farmed it for them. This economic system, called *manorialism*, began to decline during the 1000's. Many peasants began moving to cities to earn a living. Some became merchants or craftsmen. Others farmed land outside the cities and helped supply food for the city dwellers.

The growth of trade played the leading part in the economic progress of medieval cities. Trade had declined after the fall of the Roman Empire. But Venice, an Italian city, traded with Constantinople (now Istanbul), Turkey, throughout the Middle Ages. Venice remained prosperous even after other European cities declined. After those cities began to grow again, Venice traded with them. The cities grew and prospered and traded with each other. The increased trade brought further growth and prosperity to European cities.

Cities that played an especially important part in the economic revival included Antwerp in Belgium; Bruges in Flanders; Nantes, Orléans, Paris, and Rouen in France; Cologne, Hamburg, and Lübeck in Germany; and Genoa and Pisa, in addition to Venice, in Italy.



Engraving from *L'Ambassade de la Campagnie Orientale* by Pierre de Goyer and Jacob de Keyser; Newberry Library, Chicago

Many Eastern Cities prospered, even while European cities were struggling to survive in the early Middle Ages. Canton, China, above, was among the busiest medieval trading centers. It became one of the first Eastern cities to trade with the West.

Oriental trading centers included the Chinese cities of Canton, Hangchow, Kaifeng, Peking, and Soochow.

Technological advances also aided the economic progress of medieval cities. New products included barrels and tubs, gunpowder, mechanical clocks, paper, printing presses, and soap. The use of water and wind power to make products increased production, thus raising standards of living and stimulating city growth. The invention of the printing press enabled people to get information about business and government more quickly than ever before. Newspapers and printed books increased the exchange of ideas among people.

Craftsmen and merchants benefited greatly from the economic progress. Because of the expanding trade and new inventions, craftsmen could make more goods and merchants could sell more. The new prosperity drew even more people to the cities, providing additional markets for the craftsmen and merchants.

The craftsmen and merchants formed a new economic class—the *middle class*. To ensure their continued prosperity, they formed organizations of workers called *guilds*. There were guilds for merchants and craft guilds for bakers, brewers, goldsmiths, tailors, weavers, and other workers. By banding together, the guild members increased their profits. In groups, they could buy large quantities of materials and goods at low prices. The guilds allowed only their members to make and sell products. They kept their memberships low so that each member could prosper. See GUILD.

Illustration from an illuminated manuscript (1400's) by an unknown artist; Bibliothèque Publique et Universitaire, Geneva (Jean Arlaud Photograph)

Skilled Craftsmen build up a medieval city while inspectors look on. Craftsmen and merchants of medieval Europe gained prosperity and a strong voice in city government. These people made up a new economic class called the *middle class*.

F & N Schwitter

Siena, Italy, was one of several European cities that became self-governing during the 1000's and 1100's. A council of merchants, elected by the people, ran the government. Siena's towering city hall, *background above,* was the center of government.

Government. A system of government called *feudalism* developed in Europe during the Middle Ages. The feudal system divided kingdoms into sections called *fiefs*, each ruled by a lord or bishop. Feudalism weakened the power of kings because a king ruled only the land he owned, rather than an entire kingdom. Cities were governed by the lord or bishop who owned the land on which they stood. See FEUDALISM.

As cities gained importance during the 1000's and 1100's, many city people began to resent the interference of lords and bishops in local affairs. Led by the merchant and craft guilds, citizens fought for the right to govern themselves.

Many cities succeeded in their struggle for self-government. In Milan and other Italian cities, the people won the right to elect *consuls* (men who ran the city government). The practice of electing consuls then spread to other parts of Europe. Cities in Flanders and northern France achieved a high degree of independence. The people made their own laws and elected their own officials. Guild members ran many of the cities. Some kings supported the people in their fight for self-government because strong city governments weakened the power of the lords and bishops.

During the 1400's and 1500's, many kings gained power over large regions. They set up strong central governments, which reduced the power of cities.

In the East, government remained centralized throughout the Middle Ages. The king or emperor appointed local officials, but he took steps to name capable men. In China, a candidate for office had to pass a civil-service examination. After being appointed, he was watched by government inspectors. This system allowed the emperor to know about the mistakes made by local officials.

CITY/*Industrial Cities*

For about 300 years after the Middle Ages, cities throughout the world grew and gradually changed. But the basic pattern of cities and city life remained much the same. During the 1700's and early 1800's, the period of the *Industrial Revolution*, many cities in Europe and North America changed greatly. These communities—called *industrial cities*—became centers of large-scale manufacturing. The manufacturing boom resulted chiefly from the invention of machines that did the work of many men, and of the steam engine, which powered the machines.

Life in industrial cities centered around factories, where the manufacturing took place. Most of the people worked in the factories, lived near them, and depended on them completely for their livelihood. Living conditions in industrial cities improved gradually during the 1800's and early 1900's. But when the Industrial Revolution began, most people were overworked, underfed, poorly housed, and exposed to the danger of death from disease. See INDUSTRIAL REVOLUTION.

The Industrial Revolution had little immediate effect on cities outside Europe and North America. Some cities of Africa, Asia, Australia, and South America became industrial centers in the late 1800's and the 1900's. Others never became industrialized.

Description. Some industrial cities developed from medieval cities. When a city became too crowded, the walls were knocked down and the city was expanded. Other industrial cities grew up where there had been a fort, a trading post, a village, or open land. Development in open areas occurred most commonly in North America, which had no cities during the Middle Ages.

A factory or a group of factories stood near the center of an industrial city. Nearby stood the cheap houses and apartment buildings where the poor people lived. The poor had no means of transportation, and so they had to live within walking distance of their jobs. Many wealthy people, including merchants and factory owners, built big houses in the outer sections of the city. They owned horse-drawn carriages that took them to and from the central area. This pattern of living reversed that of earlier cities. In ancient and medieval times, most of the rich people lived in the inner city, and the poor people lived in the outer sections.

Industrial cities had sanitation problems similar to those of earlier cities. Garbage and other wastes produced health hazards because of inadequate sanitation systems. In addition, a new problem—pollution from industry—became a health hazard. Factories polluted the waterways with chemical wastes and polluted the air with harmful gases. They also created huge dumps of garbage, rusting metals, and other wastes.

The *gridiron pattern* of city blocks, which remains common today, came into widespread use in industrial cities. In this pattern, buildings are spaced more or less evenly apart and groups of them form rectangular blocks. Streets, generally of the same width, separate the blocks from each other. Most earlier cities had a more irregular arrangement of buildings and many winding streets. The regular pattern made it easy to extend a city in any direction. But it also gave a city a monotonous appearance.

The People. City populations increased greatly during the Industrial Revolution for two main reasons. First, the population of the world was increasing faster than ever. Second, improvements in agricultural methods had reduced the need for farmworkers. These workers flocked to the cities and took jobs in factories.

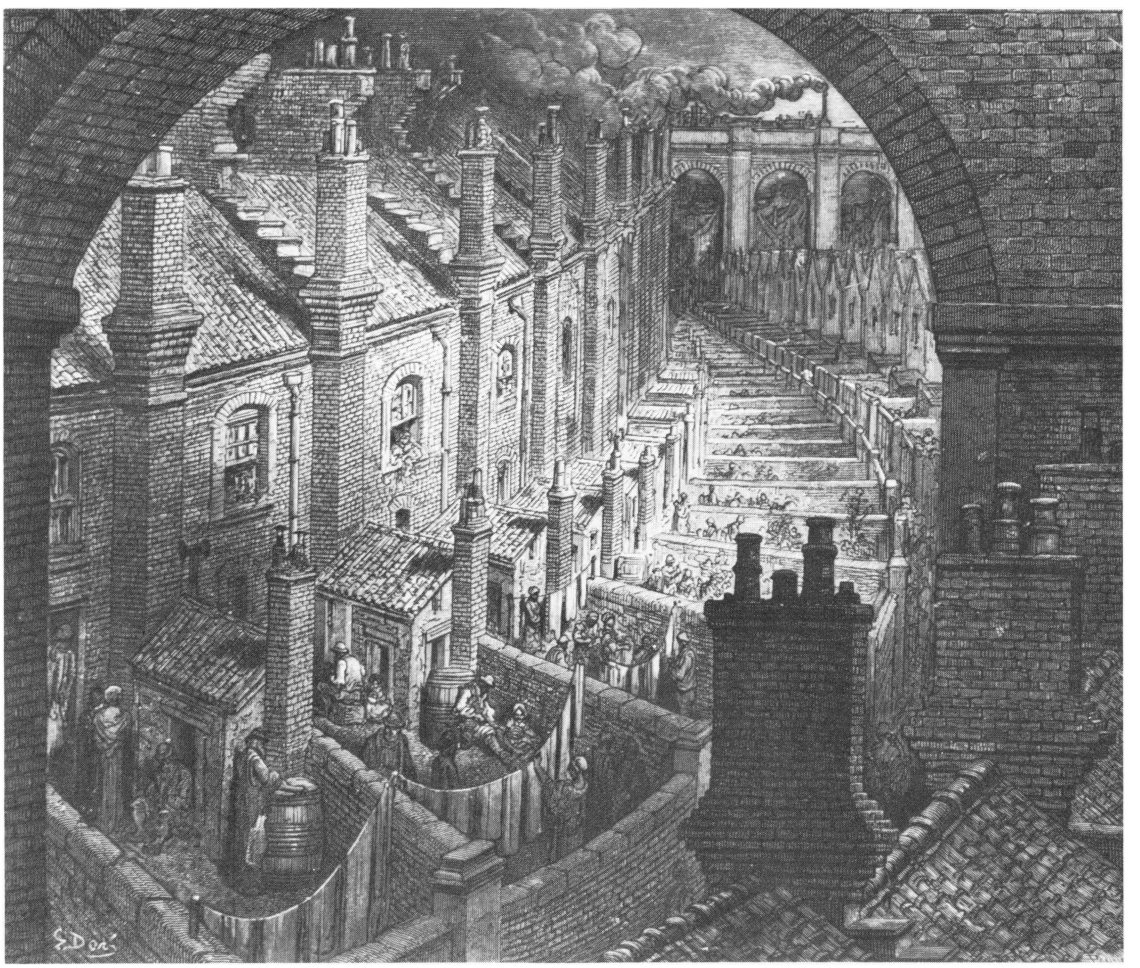
Manchester, England, and Chicago provide two examples of the tremendous growth of industrial cities. Manchester's population grew from about 6,000 in 1685 to about 303,000 in 1851. Chicago's population jumped from about 4,000 in 1840 to more than 1 million in 1890.

In the early years of the Industrial Revolution, most city people lived under miserable conditions. Men—and even many women and children—worked 12 or more hours a day in dark, dirty factories. They held monotonous, tiring jobs, such as tending a machine or carrying heavy materials. The factories had few safety rules, and accidents killed or injured many workers.

The workers earned barely enough to feed themselves and their families. During economic slumps, factories laid off large numbers of workers who had nowhere to turn for relief. They could no longer farm the land for food, and governments had not yet begun to provide widespread relief for the needy. Sometimes workers rioted in protest against their living conditions.

The workers lived in poorly built, dirty *tenements* (crowded apartments), *row houses* (groups of houses without space between them), and even in cellars. At one time, about a sixth of the people of Liverpool, England, lived in cellars. The early industrial cities had widespread disease and high death rates. Pollution filled the air and the waterways, and rats and insects spread illness. The rich and the poor both fell victim to pollution and spreading disease. Until the 1830's, the homes of even most of the rich lacked plumbing for toilets and bathtubs. Most workers did not have these facilities until the late 1800's or early 1900's.

In time, the standard of living in most industrial



Engraving (1872) by Gustave Doré; The Mansell Collection

The Industrial Revolution increased the production of goods, but it also brought miserable living conditions at first. Farm people in Europe and North America flocked to cities to take newly created jobs in factories. But like the Londoners above, most of them lived crowded together near the factories.

Detail from an engraving (1872) by Gustave Doré; Newberry Library, Chicago

An Early Traffic Jam developed when sheep slowed the people and vehicles on an already crowded London street, *above*.

cities improved. The mass production method used in the factories reduced the cost of making goods and thus cut the cost of the goods to customers. Many factory workers formed labor unions and threatened mass strikes to support their demands for higher wages and better working conditions. Finally, governments passed wage and welfare laws that helped the workers. The governments also took steps to improve sanitation.

A small percentage of the people had great wealth throughout the Industrial Revolution. Factory owners made huge profits from the business boom and paid their workers little. Bankers and financiers invested money in the new industries and made big profits on their investments. Merchants sold more and more goods as city populations grew. These rich people lived in large houses and could afford many luxuries.

During the 1700's and 1800's, charitable organizations and governments started tuition-free schools in many cities. These schools gave poor children a chance to have a formal education. But many teachers lacked good training, and many schools lacked textbooks. Also, many children could not go to school because they had to work in factories. Children of wealthy families went to private schools or studied at home under tutors.

As in medieval times, the cities included people from a variety of backgrounds. People still tended to settle in neighborhoods with others of the same background. But various groups had much more contact with each other than they had in medieval cities. People from all groups worked together in factories, and children from many groups attended schools together. The influence of the family on the behavior and ideas of the individual remained strong. But the influence of people outside the family—fellow-workers, friends, teachers, and others—increased greatly.

Economy. The flow of workers from farms to cities rose tremendously during the Industrial Revolution. The manufacturing boom provided more jobs in cities

Carnegie Library of Pittsburgh

Factories, such as those in Pittsburgh, *above*, turned out products quickly and cheaply. Factory workers, underpaid at first, later shared more in the profits that resulted from the factory system.

than ever before. At the same time, technological advances in agriculture reduced the number of jobs available on farms. The invention of the reaper, for example, enabled one farmer to do the work of many.

Large numbers of craftsmen became factory workers. Craftsmen made their products slowly, usually with hand tools. Factory workers, using machines, made products much more quickly. Factory workers began to make many of the same products that the craftsmen made. These mass-produced goods were easier to make, and so they could be sold much more cheaply than the craftsmen's goods. Many craftsmen could not compete with the factories, which forced them out of business.

The factory system of manufacturing began the greatest economic boom in history. With machines, man turned out products more quickly and cheaply than ever. The savings in production costs—together with fairer policies toward workers—resulted in greater earnings for workers. As their earnings increased, workers could buy more goods. The increased demand for goods led to increased production. Businessmen built new factories and expanded existing ones. The new business created jobs for more people, and the new jobs meant that people had more money with which to buy things. Thus, the demand for products increased again. This process of economic expansion is still going on.

Technological advances in transportation and communication aided the economic boom. The development of the steam-powered railroad train gave businessmen a way to send extremely heavy loads of products and raw materials over long distances. The railroad became—and remains—the chief method of transporting goods across land. The invention of the telegraph and, later, the telephone made communication within and between cities more efficient than ever before. Businessmen could send and receive orders for goods more quickly than they could by using the mail.

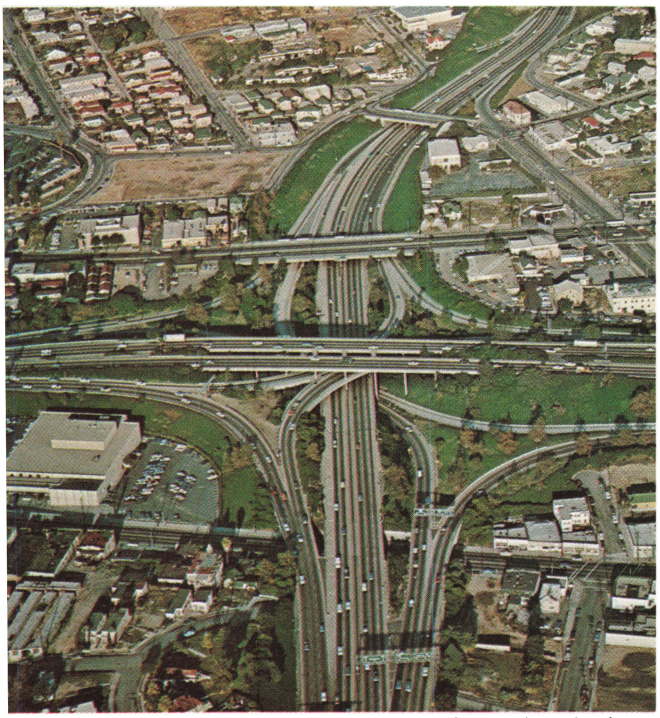
Businessmen had to spend enormous amounts to obtain raw materials, build factories, and make and operate machines. The cost was met in part through the use of the economic system called *capitalism*. Under capitalism, bankers and private investors put up money to help pay for business operations. Their investments entitle them to share in the business profits. In early industrial cities, only the wealthiest people could invest in businesses. But as time went on, many more people took part in the system.

Government. The rapid growth of city problems during the 1700's and 1800's forced governments to take steps to improve city life. Governments of industrial nations passed laws during the 1800's that were designed to help workers. These laws included measures that regulated child labor and provided income for injured workers and for families of workers who were killed on the job. Other laws improved public health care and provided food and shelter for the unemployed.

In most countries, the central government passed the laws that benefited city people. In the United States, the federal government generally left city affairs to the state governments. Reform bills had to be approved by the state legislatures. But the majority of the legislators represented farm areas, and they opposed many measures that would have benefited cities. Reform came about more slowly under this system than through direct action by the central government.

Aerofilms

Letchworth, England, *above,* was designed in the early 1900's along principles laid down by Ebenezer Howard. Howard and many other people tried to eliminate the crowded, dirty conditions of industrial cities. The plans for this small town near London called for open space and for the separation of industrial and residential areas. Howard's ideas influence city planners today.



California Division of Highways

A Metropolitan City is a giant community with suburbs nearby. In Los Angeles, *above*, and other American metropolitan cities, expressways connect the center of town and surrounding communities. These high-speed highways enable millions of people to travel from their homes in the suburbs to their jobs in the city.

Cities have grown more than ever during the 1900's. In 1970, about 1,600 cities had more than 100,000 persons, and about 100 cities had over 1 million people. Shanghai, the world's largest city, has a population of about $10\frac{3}{4}$ million. New York City, the largest in the United States, has about 8 million persons.

An even more striking growth has taken place in the areas near big cities. Large numbers of people have settled in these areas in the 1900's and have set up communities called *suburbs*. The great masses of people that had filled the cities are crowding both the cities and the land that surrounds them. See SUBURB.

A city with suburbs is a *metropolitan city*, and the city and the area around it is a *metropolitan area*. The word *metropolitan* comes from Greek words meaning *mother city*. The Tokyo metropolitan area is the largest in the world. It has about $11\frac{1}{2}$ million persons. Not all cities are metropolitan cities, but the largest ones are. The metropolitan areas of the United States are shown on a map in the METROPOLITAN AREA article.

The population explosion played an important part in the development of metropolitan areas. The world's population tripled between 1850 and 1970. This record population explosion led to overcrowded cities, causing many people to move to outlying areas. The population implosion, in which people moved from rural to urban areas, also helped build up metropolitan areas. The population displosion, in which people of various racial, religious, and national backgrounds moved into cities, also played a part in the growth of metropolitan areas. After poor people and minority groups, such as Negroes in the United States, moved into central cities, many well-to-do people moved to the suburbs.

Economic growth also aided the development of metropolitan areas. The booming economies of industrial nations helped millions of people achieve a high living standard. As a result, many people could afford expensive suburban homes.

The automobile, a major transportation advance of the 1900's, spurred the development of metropolitan areas and became a necessity of life for millions of people. In the 1890's, cars were so new and unusual that they were exhibited in circuses. Today, there are about 175 million passenger cars in the world—most of them in advanced nations. In the United States, most families own at least one automobile, and many own more than one. The car enables millions of people to live far from their jobs, schools, and shopping centers (see AUTOMOBILE [introduction; The Family Car]). The commuter railroad, which carries many suburban workers between their homes and jobs, also aided the development of metropolitan areas.

Description. Today's cities are much larger than those of earlier times. In the late 1400's, for example, Paris covered about 3 square miles (8 square kilometers). The city now covers 41 square miles (106 square kilometers), and its metropolitan area stretches over 185 square miles (479 square kilometers).

Most metropolitan cities in the United States have a similar layout. The main business section, often called *downtown*, lies in the center of the city. It is the busiest part of the community. People from throughout the metropolitan area work in offices and stores there and shop in downtown stores. The business section covers a small area. But it can serve thousands of people daily because many offices and stores are in skyscrapers.

An industrial region of factories, warehouses, and shipping yards lies next to or encircles the main business section of many cities. The residential areas, where most of the people live, begin beyond the industrial region. The oldest and most run-down houses are in the residential area closest to the city center. Most of the city's poor people live in this area, often called the *inner city*. The local and federal governments have undertaken urban renewal projects in many inner cities. Some of the worst slum buildings have been replaced by new, low-cost housing. Much of this housing consists of high-rise apartment buildings.

The neighborhoods become newer and more attractive away from the inner city. The best homes stand near the edges of the city and in the suburbs. Each residential area has its own stores and other businesses. During the mid-1900's, many factories were built away from the central industrial sections of cities, especially in suburban areas.

The main streets of cities and suburbs are often jammed with automobiles, buses, and trucks. At such times, traffic creeps along slowly, delaying and angering large numbers of people. Many wide expressways

PROFILE OF A METROPOLITAN AREA

The Chicago Area in 1871

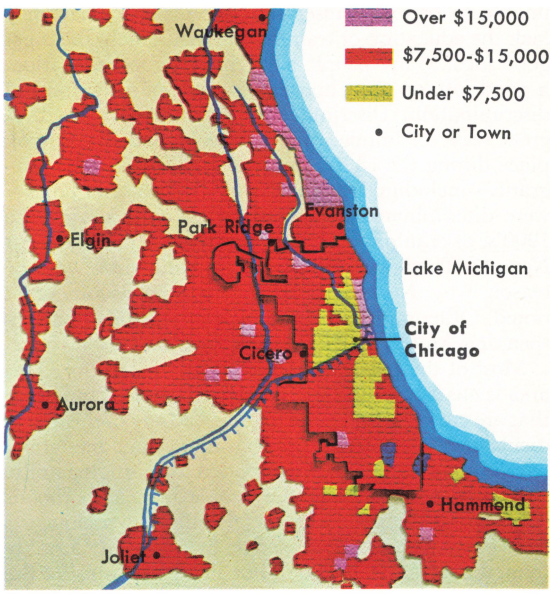
The map below shows Chicago and its surrounding area in 1871. (The city itself is slightly raised on all the maps on this page.) Chicago was already a major trading center partly because it lay along important land and water routes. Its population was about 300,000, a jump from about 4,000 in 1840. But most of the land near the city was thinly populated and undeveloped.

The Chicago Area Today

In the 1900's, Chicago became the center of a huge metropolitan area. The city expanded its boundaries, *below,* and its population rose to more than 3⅓ million. Nearly 3⅔ million persons live in the city's Illinois suburbs. The 633,000 persons living nearby in Indiana are often included in the Chicago area. Airports, expressways, and railroads serve the area.

Yearly Family Income in the Chicago Area

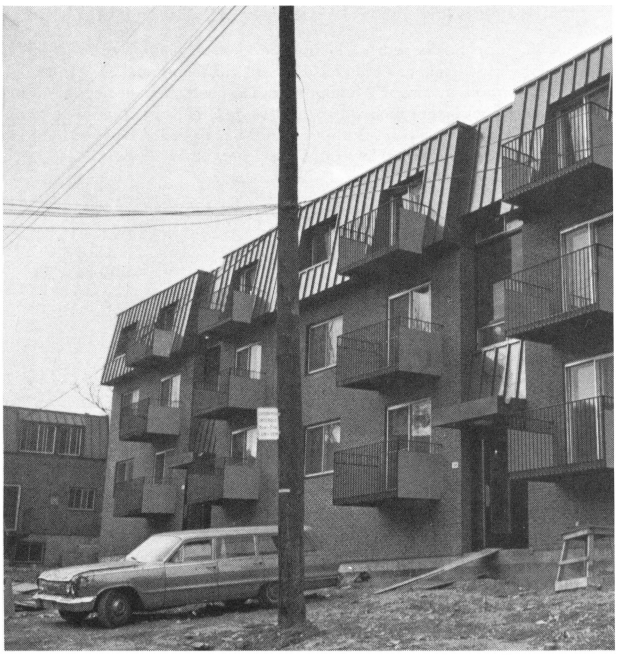
This map shows where low-income, middle-income, and high-income families live in the Chicago area. The pattern is typical of many cities. Most low-income families live in old sections near the center of the city. Most families with middle and high incomes live away from the center and in the suburbs. Some high-income families live near the main business section, in the city's center.



Land Use in the Chicago Area

This map shows how land is used in the Chicago metropolitan area. A large industrial section lies near the center of the city. Another big industrial section begins near the south end of Chicago and extends past Hammond, Ind. Today, many businesses are also building factories in the suburbs. Most of the metropolitan area is residential, with recreational areas scattered throughout.

WORLD BOOK illustrations by George Suyeoka



Pictorial Parade

Urban Renewal has transformed slums into attractive, residential neighborhoods in many metropolitan cities. In the Little Burgundy section of Montreal, run-down buildings, *left*, have been replaced by new, low-cost housing, *right*.

have been built to help carry the traffic. But the number of motor vehicles has increased so greatly that traffic jams occur on expressways as well as streets.

Many cities in developing nations still have poor garbage and waste removal systems. But in general, the cities of other nations have adequate sanitation. On the other hand, these cities have another serious environmental problem—pollution. Motor vehicles, factories, electric power plants, and other sources create so much air pollution that it sometimes hangs in the air like dirty fog. Air pollution, somewhat like wastes of earlier days, threatens the health of the people in cities. In addition, city wastes that are poured into waterways kill fish and make some waterways unfit for swimming.

The People. The population of urban places has continued to increase since the Industrial Revolution. Today, more than a fourth of the world's 4,038,000,000 people live in communities of 20,000 or more population. The United States classifies about 73 per cent of its population as urban. In Canada, about 76 per cent of the people live in urban places. Since 1945, suburban growth has been even more spectacular than city growth. In the United States, more people now live in suburbs than in central cities.

On the whole, the people in the metropolitan areas of North America and Western Europe have the highest standard of living in history. There are many more wealthy and middle-income people than ever before.

Most people in metropolitan areas have good housing, send their children to well-equipped schools, and can afford the necessities—and many luxuries—of life. Workers in all occupations have benefited from the booming economy and the increased strength of the labor movement during the 1900's. But, as has been true throughout history, many people live in poverty.

The existence of poverty amid great wealth ranks among the chief problems of today's cities. The poor want to share in the general wealth, but many are unable to better themselves economically. They may lack the education or training that could help them get good jobs. Many people are denied a good education, a good job, or good housing because of some kind of discrimination. Discrimination has always existed. A great wave of immigration to the United States took place during the 1800's and early 1900's. Many immigrants—including Irishmen, Italians, Jews, and Poles—were discriminated against. In U.S. cities during the 1900's, discrimination has been directed chiefly against Negroes. The anger felt toward discrimination was one reason why Negroes in U.S. cities have sometimes rioted. Other targets of discrimination include Spanish-speaking Americans and American Indians.

Most of the poor people live in the inner city. This area is characterized by run-down apartment buildings that are crowded and close together. Many of the apartments have been divided so that more than one family lives in quarters originally intended for a single family.

A large percentage of the people in neighborhoods just beyond the inner city are classified by sociologists as *lower middle class*. These people live more comfortably than the poor people, but not nearly so well as the

COMPARING THE SIZES OF CITIES

A city determines its population by counting the people that live within its political boundaries. But cities of the world define their city limits differently, making population comparisons difficult. United States cities fix their limits so that they do not overlap or include other cities and towns. Some foreign cities include other urban and rural areas.

Countries also determine metropolitan areas in various ways. In the United States, metropolitan area boundaries follow county lines. Each metropolitan area includes a county with a large city and perhaps nearby counties. But in most countries, a metropolitan area does not have definite political boundaries. Such areas include the major city and a variety of urban and rural areas that are socially or economically identified with the city.

Shanghai has the largest population of any city in the world. But it includes an urban center and a large rural area. The Tokyo metropolitan area, known as the Metropolis of Tokyo, has the largest population of any metropolitan area. It includes 26 suburban cities and one county area.

The city and metropolitan populations in the tables below are census figures or estimates from governments or from *Demographic Yearbooks* of the United Nations Statistical Office. If these sources do not report a metropolitan population, the same city proper figure appears in both the cities and the metropolitan areas tables to show the existence of a metropolitan area.

50 LARGEST CITIES IN THE WORLD

1. Shanghai	10,820,000	26. Calcutta	3,148,746
2. Tokyo	8,840,942	27. Madrid	3,146,071
3. New York City	7,895,563	28. Osaka	2,980,487
4. Mexico City	7,768,033	29. Buenos Aires	2,972,453
5. Peking	7,570,000	30. Lima	2,862,197
6. London	7,344,820	31. Los Angeles	2,809,813
7. Moscow	7,050,000	32. Rome	2,795,168
8. Bombay	5,970,575	33. Harbin	2,750,000
9. Seoul	5,536,377	34. T'ai-yüan and Yü-tz'u	2,725,000
10. São Paulo	5,241,232	35. Sydney	2,717,069
11. Cairo	4,961,000	36. Bogotá	2,680,100
12. Jakarta	4,576,009	37. Santiago, Chile	2,661,920
13. Hong Kong	4,413,000	38. Paris	2,590,771
14. Rio de Janeiro	4,315,746	39. Pyongyang	2,500,000
15. Tientsin	4,280,000	40. Madras	2,469,449
16. Wuhan	4,250,000	41. Melbourne	2,388,941
17. Port Arthur-Dairen	4,000,000	42. Istanbul	2,376,296
18. Teheran	3,858,000	43. Canton	2,300,000
19. Mukden	3,750,000	44. Yokohama	2,238,264
20. Leningrad	3,563,000	45. Lahore	2,148,000
21. Chungking	3,500,000	46. Singapore	2,074,507
22. Karachi	3,469,000	47. Budapest	2,038,787
23. Chicago	3,369,357	48. Nagoya	2,036,053
24. Delhi	3,287,883	49. Alexandria	2,032,000
25. Berlin (East and West)	3,219,741	50. Changtu, China	2,000,000

50 LARGEST METROPOLITAN AREAS IN THE WORLD

1. Tokyo	11,408,071	27. Delhi	3,647,023
2. Shanghai	10,820,000	28. Karachi	3,469,000
3. Mexico City	10,223,102	29. Berlin	3,219,741
4. New York City	9,943,800	30. Madras	3,169,930
5. Buenos Aires	8,352,900	31. Lima	3,158,417
6. Paris	8,196,746	32. Madrid	3,146,071
7. São Paulo	8,062,130	33. Istanbul	3,135,354
8. Peking	7,570,000	34. San Francisco-Oakland	3,108,782
9. London	7,344,820	35. Osaka	2,980,487
10. Moscow	7,172,000	36. Washington, D.C.	2,909,355
11. Rio de Janeiro	7,094,211	37. Boston	2,899,101
12. Chicago	7,084,700	38. Bogotá	2,818,300
13. Calcutta	7,031,382	39. Rome	2,795,168
14. Los Angeles-Long Beach	6,999,600	40. Montreal	2,743,208
15. Bombay	5,970,575	41. T'ai-yüan and Yü-tz'u	2,725,000
16. Seoul	5,536,377	42. Sydney	2,717,069
17. Cairo	4,961,000	43. Santiago, Chile	2,661,920
18. Philadelphia	4,824,110	44. Toronto	2,628,043
19. Jakarta	4,576,009	45. Nassau-Suffolk, N.Y.	2,555,868
20. Detroit	4,435,051	46. Athens	2,540,241
21. Hong Kong	4,413,000	47. Pyongyang	2,500,000
22. Tientsin	4,280,000	48. St. Louis	2,410,492
23. Leningrad	4,002,000	49. Pittsburgh	2,401,362
24. Port Arthur-Dairen	4,000,000	50. Manchester	2,389,220
25. Teheran	3,858,000		
26. Mukden	3,750,000		

50 LARGEST CITIES IN THE UNITED STATES

1. New York City	7,895,563	26. Kansas City, Mo.	507,330
2. Chicago	3,369,357	27. Atlanta	497,421
3. Los Angeles	2,809,813	28. Buffalo	462,768
4. Philadelphia	1,949,996	29. Cincinnati	451,455
5. Detroit	1,513,601	30. Nashville	447,877
6. Houston	1,232,802	31. San Jose	445,779
7. Baltimore	905,787	32. Minneapolis	434,400
8. Dallas	844,401	33. Fort Worth	393,476
9. Washington, D.C.	756,510	34. Toledo	383,105
10. Cleveland	750,879	35. Newark	381,930
11. Indianapolis	746,302	36. Portland, Ore.	379,967
12. Milwaukee	717,372	37. Oklahoma City	368,377
13. San Francisco	715,674	38. Louisville	361,706
14. San Diego	697,027	39. Oakland	361,561
15. San Antonio	654,153	40. Long Beach	358,879
16. Boston	641,071	41. Omaha	346,929
17. Memphis	623,530	42. Miami	334,859
18. St. Louis	622,236	43. Tulsa	330,350
19. New Orleans	593,471	44. Honolulu	324,871
20. Phoenix	581,562	45. El Paso	322,261
21. Columbus, O.	540,025	46. St. Paul	309,714
22. Seattle	530,831	47. Norfolk	307,951
23. Jacksonville, Fla.	528,865	48. Birmingham, Ala.	300,910
24. Pittsburgh	520,117	49. Rochester, N.Y.	296,233
25. Denver	514,678	50. Tampa	277,753

50 LARGEST CITIES AND TOWNS IN CANADA

1. Montreal	1,214,352	28. Sault Ste. Marie	80,332
2. Toronto	712,786	29. Verdun	74,718
3. Winnipeg	535,217	30. LaSalle	72,912
4. Edmonton	438,152	31. Ste.-Foy	68,385
5. Vancouver	426,256	32. Niagara Falls	67,163
6. Calgary	403,319	33. Dartmouth	64,770
7. Hamilton	309,173	34. Brantford	64,421
8. Ottawa	302,341	35. Hull	63,580
9. Laval	228,010	36. St.-Laurent	62,955
10. London	223,222	37. Victoria	61,761
11. Windsor	203,300	38. Oakville	61,483
12. Quebec	187,833	39. Guelph	60,087
13. Mississauga	156,070	40. Kingston	59,047
14. Regina	139,469	41. Peterborough	58,111
15. Saskatoon	126,449	42. Sarnia	57,644
16. Halifax	122,035	43. Trois-Rivières	55,869
17. Kitchener	116,966	44. St.-Léonard	52,040
18. St. Catharines	109,722	45. North Bay	49,187
19. Thunder Bay	108,411	46. Moncton	47,891
20. Sudbury	100,446	47. Cornwall	47,116
21. Longueuil	97,590	48. Lachine	44,423
22. Oshawa	91,587	49. Welland	44,397
23. Montréal-Nord	89,139	50. New Westminster	42,835
24. Saint John	89,039		
25. St. John's	88,102		
26. Burlington	87,023		
27. Sherbrooke	80,711		

Architectural Camera, Ltd.

Suburbs—such as Oak Brook, *above*, near Chicago—have sprung up in large numbers around big cities during the 1900's. The population masses that had filled the cities now fill both the cities and the suburban land far beyond.

people farther out. Most of the houses are old and small. But they are in better condition and are less crowded than housing in the inner city.

Most middle-class and wealthy people live near the edges of the city or in the suburbs. Their houses are bigger, newer, and more luxurious than the houses closer in. Many of these homes have large back yards where families can play and relax in privacy. During the mid-1900's, many luxury apartment buildings went up in the suburbs. Some others were built near the city business section.

In the 1900's, there has been a gradual movement by people to the outer parts of cities and to suburbs. This movement increased greatly after World War II (1939-1945). People move out to get away from areas with high crime rates and to have better housing and cleaner, quieter, and less crowded living conditions. They also believe that their children can get a better education than in the inner city. Schools in the inner cities have been widely criticized as being too poorly equipped to educate children properly. Sociological studies indicate that many people in the United States also move toward the outer part of metropolitan areas to get away from the Negroes who live in the inner part. Today, the suburbs are populated chiefly by whites and the central cities have an increasingly larger percentage of Negroes.

Economy. The economic boom that began during the Industrial Revolution is still going on, and the markets for products made in cities continue to grow. The population explosion has created more buyers for more goods, and higher standards of living enable people to buy an increasing volume of products. Many nations have expanded their trade with other nations, creating new markets for their products. Technological advances have also made many new products available. The economies of advanced nations rely heavily on massive sales of such products as automobiles, electric and gas stoves, refrigerators, television sets, and automatic washing and drying machines.

Metropolitan cities, like industrial cities, are manufacturing centers that provide jobs for thousands of factory workers. But today's cities also have large numbers of jobs for workers in hundreds of other fields. Salesmen sell the products of industry, and transportation workers move them from place to place. Office workers help keep businesses running smoothly. Construction workers build the offices and factories needed by expanding businesses and put up the housing units for the expanding population. To manage the affairs of cities, governments employ firemen, policemen, roadbuilders, tree trimmers, sanitation workers, and many other groups of employees.

Economic growth in the 1900's has been aided by hundreds of technological advances. They include the use of electricity and gasoline to run machines and the development of plastics and other materials to make new products. Other technological advances have been radio and television and the space satellite for communication, the automobile and airplane for transportation, and the computer to handle information needed by complex economies. Jobs that have been created by technological progress include those of airplane pilots, computer operators, electricians, mechanics and repairmen, and service station attendants.

Economic activity in metropolitan areas has become increasingly decentralized. Many business firms have built factories in the suburbs while keeping their main offices in the city.

Government. The governments of metropolitan cities have grown into large, complex organizations. They face the challenging tasks of providing services for thousands or millions of people and of helping rebuild aging, decaying parts of cities. They are hard-pressed to get the funds they need to do their work, and their problems increase as urban populations continue to grow. For further information, see the *Governmental Problems* section of this article.

Cities are the cultural, economic, governmental, population, transportation, and communication centers of the world. They are places where most people can find a job and earn a living and where some people can accumulate moderate or great wealth. In cities, people can also choose from a variety of cultural and recreational activities that add to the enjoyment of life. Nevertheless, cities have many physical, social, economic, and governmental problems.

Physical Problems of cities include substandard housing, pollution, and traffic congestion.

The term *substandard housing* refers to poorly constructed, run-down, unsanitary, or overcrowded dwellings. In developing nations, millions of people live in crude shacks or other dwellings that barely provide shelter. The people of advanced nations are better off. Even so, some housing in advanced nations is also substandard. In the early 1970's, about 5½ per cent of the occupied housing units in the United States were considered substandard. Governments have set up various programs to get rid of substandard housing and provide decent housing for needy families. But population growth, lack of funds, the high cost of construction, and other factors continue to cause a worldwide housing crisis. Substandard housing and attempts to solve the problem are discussed in detail in the HOUSING article.

Motor vehicles, factories, electric power plants, and other sources pollute city air with fumes that endanger the health of the people. Wastes from factories and other sources pollute waterways. But the same things that cause pollution also aid a city's economy and give its people conveniences. A government might want to end pollution immediately by eliminating all sources of pollution. But to do so, it would have to close factories and electric power plants and prohibit automobiles—and thus cripple the economy of the community and inconvenience the people. Instead, governments, industry, and science must seek ways to reduce pollution without upsetting the urban way of life. See AIR POLLUTION; WATER POLLUTION.

At any time—but especially during the morning and evening rush hours—the main streets of cities and suburbs can become jammed with motor vehicles. Such traffic jams delay and anger people trying to get to and from work and other places. Governments have built expressways, tried to improve public transportation, and taken other steps to try to relieve traffic congestion. Even so, getting from place to place in a metropolitan area becomes more and more difficult because of population growth and the ever-increasing use of cars.

Social Problems in today's cities include friction between people of different backgrounds; and crime, juvenile delinquency, alcoholism, and drug addiction. Poverty—both a social and an economic problem—is discussed under *Economic Problems*.

The population displosion has led to conflicts between groups of people. Often, groups with different cultural backgrounds fear and distrust each other and view each other's way of life as inferior. Such attitudes have caused violence between groups. Examples in the 1900's include conflicts between Protestants and Roman Catholics in Northern Ireland; Hindus and Moslems in India and Pakistan; blacks and whites in Rhodesia, South Africa, and the United States; and language groups in India. In some places, governments have passed laws to protect minority groups from injustices. But group conflicts will continue until people learn to live together peacefully.

Such antisocial behavior as crime, juvenile delinquency, alcoholism, and drug addiction arises in part

S. E. Hedin, Carl Östman

Substandard Housing ranks among the most serious city problems. In spite of government efforts to improve housing, many dwellings like the shacks in New Delhi, India, above, remain.

Pictorial Parade

Travel in Cities is often difficult. People must crowd into trains and buses and drive on jammed roads. In Tokyo, above, workers called *pushers* cram passengers into the trains.

Wide World

Friction Between People of Different Backgrounds is a major city problem. For example, many people oppose busing as a way to achieve balance among racial groups in public schools.

from the inability of some people to adjust to urban living. Sociologists point to urban society's impersonal relationship toward individuals as a cause of this inability. Some people come to feel that they have no place in society. They may turn to crime or delinquency as a way of lashing out at society or making material gains. Or they may seek escape from society through overuse of alcohol or drugs. Stricter law enforcement might help reduce antisocial behavior, but the problem cannot be eliminated completely until its causes are eliminated. Private and governmental organizations have been established to try to reduce antisocial behavior. These groups publicize the dangers of such behavior. They also work with former convicts, juvenile delinquents, alcoholics, and drug addicts to help them overcome their problems and find places in society.

Economic Problems. Most people in the cities of advanced nations enjoy a high standard of living. But even in the best times, a city has many poor people. Poverty has always existed, but the great wealth of today's cities highlights the problem. The poor see other people enjoying comfortable lives, and their resentment toward their own condition grows. The anger felt by the poor toward society has sometimes led to riots. Governments, individuals, and charitable and social action organizations work to eliminate poverty. They try to improve educational and job opportunities for the poor, and they provide many poor people with financial aid. For a detailed discussion of the problem and steps taken to solve it, see POVERTY.

Complex economic and social factors sometimes lead to business slumps. During a slump, many workers lose their jobs and the number of needy people in cities increases. The workers can collect unemployment pay from the government, but this pay is much less than their usual income. Unemployed workers cut down on their buying, and business suffers further.

Governmental Problems. Through the years, the job of governing cities has become increasingly complex. Today, city governments find themselves hard-pressed to rebuild aging, decaying areas and to provide satisfactory schools, police protection, and other necessary services. Population growth and change, lack of funds, lack of authority, and conflicting authority all contribute to the difficulty of governing cities.

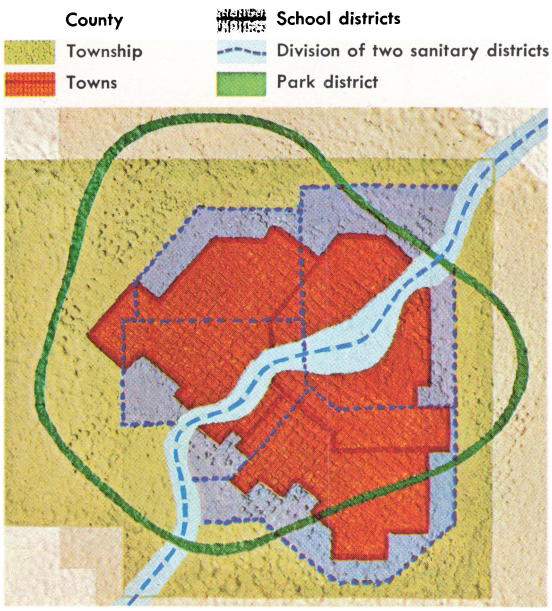
The constant growth of city populations means that city governments have to provide services for an ever-increasing number of people. Also, many people who move into cities are poor and many who move out are well-to-do. This development means that city governments must provide financial assistance for a larger part of the population. It also means that the people who live in the cities are less able to pay for government services. Well-to-do people who move to suburbs may continue to earn a living in the city, but they no longer pay taxes to support its government. A city's tax base also shrinks when industries move to suburbs. State and federal governments contribute to the cost of operating cities. Even so, cities face a serious financial crisis.

A city government is part of a complex authority system. Each city government is subject to the regulations of its central government. In some countries, cities are also subject to the regulations of regional governments, such as those of states and provinces.

In the United States, state legislatures set up city governments to provide local services. About half the states grant cities *home rule*. That is, a city may—within the general laws of the state—adopt its own *charter* (form of government) and have considerable freedom in local matters. In a state without home rule, the state legislature decides what form of government a city will have. It also decides many city government policies, such as the kind of and rate of taxation. Legislators from rural areas often vote against measures designed to help urban areas. Thus, state control of city affairs can

METROPOLITAN AREA GOVERNMENTAL UNITS

This diagram shows some of the governmental units that operate within a metropolitan area. Solutions to areawide problems are difficult, partly because no one unit has areawide authority.



WORLD BOOK illustration by George Suyeoka

cause problems for city governments. See HOME RULE.

Many separate governmental units operate within most metropolitan areas. These units include city, suburban, county, and township governments; school districts; and special districts. Special districts include governmental units that provide for garbage collection, mosquito control, sewage disposal, and park management. No one governmental unit has authority over the entire area. Therefore, no one unit has the authority or the responsibility for dealing with such areawide problems as pollution and the flow of mass transportation. *Metropolitan governments* have been established in some metropolitan areas to provide an overall authority. A metropolitan government is responsible for an entire metropolitan area's police protection, water supply, mass transportation, and other services that can be handled most efficiently by an areawide authority. The Miami, Fla.; Nashville, Tenn.; and Toronto, Ont., areas have metropolitan governments. Many people oppose this form of government. They fear that it results in higher taxes, and they believe only small local governments can remain close to the people.

For more details on the functions and problems of local governments today, and of their relations with higher levels of government, see LOCAL GOVERNMENT. For a discussion of how city governments operate and are organized, see CITY GOVERNMENT.

Solving City Problems. Cities have made some effort to solve their problems, but much remains to be done. More money than is now available could partially solve some of the problems. Most of the funds would come from taxes paid by citizens and businesses. Some people favor extensive use of tax money for social improvement, but others oppose it.

Government regulation can also be used to help solve problems. For example, governments can demand that car manufacturers make cars that pollute the air less than today's vehicles do. Again, some people favor extensive government regulation, but others oppose it.

All city problems could not be solved completely even if everyone favored wide use of tax money and government regulation. Some governments simply could not get enough money to relieve such problems as poverty and substandard housing. Also, money cannot change the attitude of one group of people toward another. In addition, government regulation has limited usefulness, as the example of pollution control in the *Physical Problems* section of this article illustrates.

CITY/*Future Cities*

Sociologists have made various predictions about urban communities of the future. They believe that metropolitan areas will continue to grow in both population and area. In 1970, about 1,020,000,000 persons in different parts of the world lived in urban places with populations of 20,000 or more. By the year 2000, the number is expected to rise to about 3,400,000,000 persons.

In the United States in 1970, about 150 million persons lived in urban places as defined by the U.S. government. By the year 2000, the number is expected to reach about 245 million.

Some new urban communities have already been built in the 1900's, and more will be built by 2000. Like today's suburbs, the new communities will provide living space and ease the overcrowding problem caused by the population explosion and implosion. City planners hope that—unlike most suburbs—the new communities will also provide jobs for most of their residents. If the communities do so, the overcrowding of cities will be eased even more.

Communities that have such a self-supporting feature are called *new towns* or *new cities*. Great Britain and the Scandinavian countries have been leaders in the development of new towns. The governments of these nations provided much financial aid for this development. In the United States, where private enterprise plays the major role, only a few new towns have been developed. They include Columbia, Md., and Reston, Va. Construction of the new town of Jonathan, Minn., began in the late 1960's. In 1970, Jonathan became the first new town in the United States to receive a guarantee of financial assistance from the federal government. Brazil built a new capital city, Brasília, in the mid-1900's. The Brazilian government located this city in the thinly populated interior of the country. It hopes that an important, modern city there will lead to further development of the interior.

The development of new towns and cities is a slow, costly process. Private developers are reluctant to take on such projects because of the uncertainty of—and the long wait for—profits. Many governments have been unable or unwilling to finance such projects. For these reasons, sociologists predict that almost all the additional millions of people who will live in urban places by

Claus Meyer, Black Star

New Communities help reduce overcrowding in existing cities. Brasília, above, a new city in the interior of Brazil, draws some people from the crowded coastal areas of the country.

the year 2000 will crowd into existing communities. More and more of the land around central cities will be filled by people. The suburbs will spread out so far that some metropolitan areas will run together with no rural areas between them. Such a continuous stretch of metropolitan areas is called a *megalopolis*. One has nearly been formed between Washington, D.C., and Boston.

Sociologists also foresee physical changes in metropolitan areas. Most of them expect government to play a greater role in getting rid of slums and in planning urban areas and regulating their affairs. To absorb the increasing population, tall buildings may be permitted in areas where they are now prohibited. Governments may also set aside much more land for parks and other recreational areas. They may try to solve traffic problems and improve safety by creating separate roadways for automobiles, trucks, and pedestrians. See CITY PLANNING; URBAN RENEWAL.

The effort to free cities of pollution seems sure to continue. Entire urban communities may even be enclosed in plastic domes. The temperature and humidity would be controlled, and electronic filters would keep the air clean and fresh. Hopefully, future cities and suburbs will offer all the advantages of urban life without any of the disadvantages. PHILIP M. HAUSER

CITY/*Study Aids*

Related Articles. WORLD BOOK has separate articles on hundreds of cities. Lists of United States cities appear at the end of the articles on the states, and Canadian cities appear at the end of the articles on the provinces. Cities of other countries are listed at the end of the articles on those countries. See also the following articles:

HISTORY

Athens
Babylon
City-State
Egypt, Ancient
Free City
Greece, Ancient
Guild
Industrial Revolution
Middle Ages
Phoenicia
Roman Empire
Rome (The Ancient City)

CITY PROBLEMS

Air Pollution
Crime
Drug Addiction
Environmental Pollution
Juvenile Delinquency
Poverty
Riot
Segregation
Traffic (Traffic Problems)
Waste Disposal
Water Pollution

OTHER RELATED ARTICLES

Architecture
City Government
City Planning
Communication
Community
Education
Housing
Local Government
Megalopolis
Metropolitan Area
Model Cities
Park (City Parks)
Playground
Population
Public Health
School
Street
Suburb
Technology
Transportation
Urban Coalition, National
Urban Renewal

Outline

I. How Cities Began and Developed
- A. Advances in Technology
- B. Physical Environment
- C. Social Organization
- D. Population Growth

II. Ancient Cities
- A. Description
- B. The People
- C. Economy
- D. Government

III. Medieval Cities
- A. Description
- B. The People
- C. Economy
- D. Government

IV. Industrial Cities
- A. Description
- B. The People
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VI. City Problems
- A. Physical Problems
- B. Social Problems
- C. Economic Problems
- D. Governmental Problems
- E. Solving City Problems

VII. Future Cities

Questions

What are some of the reasons that so many people live in and near cities?

What are some of the problems of cities?

What city was founded by a steel company?

What is the *population explosion?* The *population implosion?* The *population displosion?*

How did medieval cities solve the problem of overcrowding?

How did people of ancient cities try to please the gods?

What is a *megalopolis?*

What European city remained a trading center throughout the Middle Ages?

How did the decline of manorialism contribute to the growth of cities?

Why can a city business section that covers a small area serve thousands of people daily?

Reading and Study Guide

See *City* in the RESEARCH GUIDE/INDEX, Volume 22, for a *Reading and Study Guide.*

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CITY COLLEGE. See UNIVERSITIES AND COLLEGES (table [New York, City University of]).

CITY GOVERNMENT manages the affairs of and provides services for *municipalities*—cities, towns, villages, and boroughs. City government is also called *municipal government*.

About 65 per cent of the people of the United States live in municipalities. State legislatures set up city governments to provide such services as education, police and fire protection, recreational facilities, street maintenance, and health and welfare services. About half the states grant cities *home rule*. That is, the cities may, within the general laws of the state, adopt their own *charter* (form of organization) and have considerable freedom in local matters. See HOME RULE.

The United States has about 18,700 *incorporated* (chartered) municipalities. Illinois leads the states with about 1,260. Hawaii, on the other hand, has no incorporated cities. All of Hawaii's cities and towns are governed as part of the county in which they are located. Nevada, New Hampshire, and Rhode Island have fewer than 20 incorporated municipalities each.

City government takes various forms in different countries and in different cities within a country. The degree of local authority and independence also varies from nation to nation. Most cities have an elected legislative body, usually called a *council*, *board of aldermen*, or *commission*. The members of these bodies may be elected from the city *at large* (as a whole) or from smaller wards or districts. In many countries, the executive or ceremonial head of city government is called the *mayor*. The powers and duties of mayors vary widely.

There are three main forms of city government in the United States: (1) mayor-council, (2) commission, and (3) council-manager. This article discusses the organization and the advantages and disadvantages of each form. For information on the functions and problems of city and other local governments, see the article on LOCAL GOVERNMENT. To learn about city government in Canada, see the section on *Local Government* in each province article in WORLD BOOK.

William C. Havard, the contributor of this article, is Dean of the College of Arts and Sciences at Virginia Polytechnic Institute and State University.

Mayor-Council Form

The mayor-council form is the oldest and most popular type of city government in the United States. The first city governments in the American Colonies were patterned after those in England. They had a council, which was the chief organ of government, and a mayor, who was a member of the council and presided over it.

Under most mayor-council systems today, the mayor operates from a separate office and is not a member of the council. The people elect both the mayor and the council. Over half the cities in the United States with populations of 5,000 or more have the mayor-council system, and a large majority of the cities under 5,000 have it.

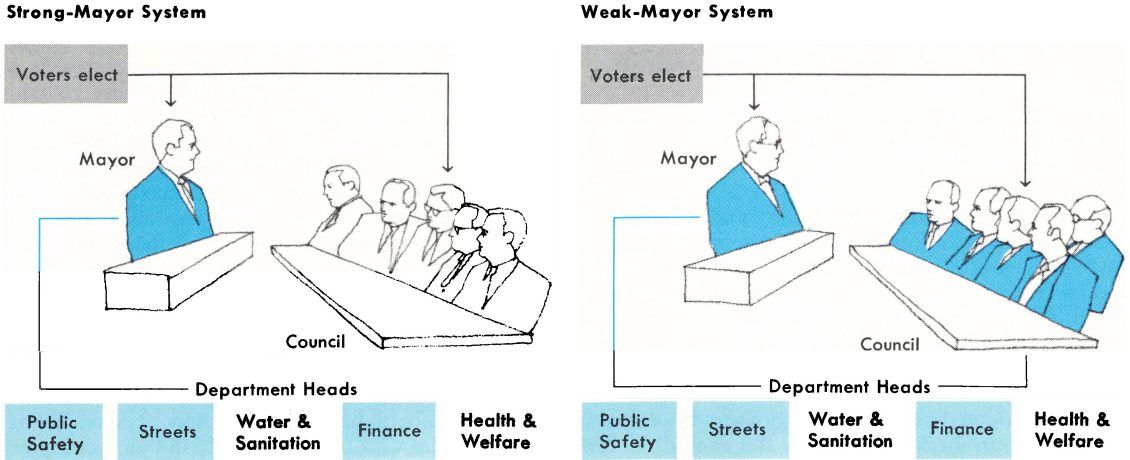
There are two main types of mayor-council government: (1) the weak-mayor system and (2) the strong-mayor system. The weak-mayor system developed in the late 1700's and is the most popular type of government in cities with populations of less than 5,000. The strong-mayor system developed in the late 1800's and is especially popular in large cities.

The Weak-Mayor System gives the mayor only limited executive authority. The council, on the other hand, has executive as well as legislative powers. In most cities, the mayor does not prepare the city budget and has little veto power over council decisions. He appoints few, if any, of the city's top administrative officials, and these appointments may be subject to the council's approval. Other administrative officials are chosen by the city council, the governor, the state legislature, the voters, or independent boards and commissions.

MAYOR-COUNCIL FORM OF GOVERNMENT

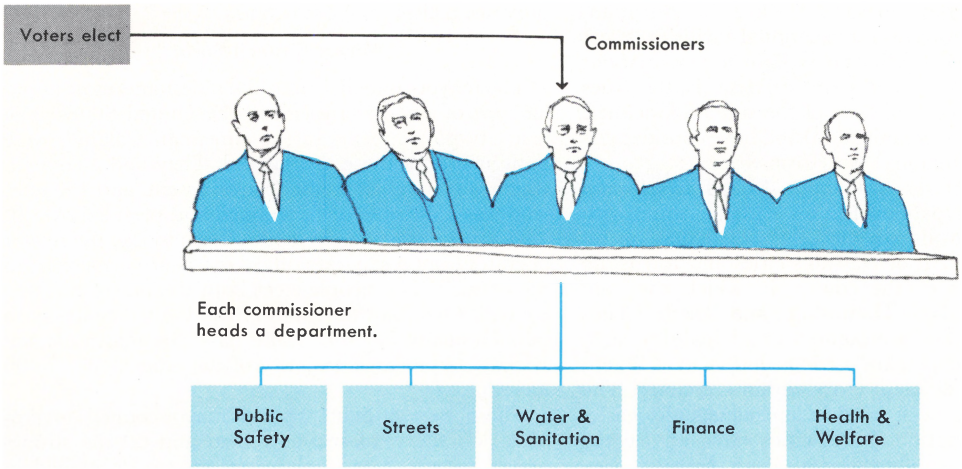
The council is the chief governing body of the city. Under the strong-mayor system, the mayor appoints most department heads and has direct control over them. Under the weak-mayor system, the mayor appoints few, if any, top administrative officials and has only limited control over them.

WORLD BOOK chart



COMMISSION FORM OF GOVERNMENT

Commissioners have both legislative and executive powers. As a group, they decide basic city policies. Each commissioner also heads a city department and is responsible for its administration.



WORLD BOOK chart

The chief criticism of the weak-mayor system is that responsibility is not centralized but divided among many officials. The mayor has difficulty coordinating the administration of city services, especially because he does not have a voice in selecting many department heads. However, some persons favor such decentralization of authority because they fear too much power vested in a single individual.

The Strong-Mayor System gives the mayor broad powers. He can appoint and dismiss most department heads, veto acts of the council, prepare the budget, plan various programs, and direct the operation of all city departments. The mayor serves as the leader in city government and proposes legislation to the city council. However, the council determines basic government policy and is responsible for raising *revenue* (money) for the city.

Most experts on city government consider the strong-mayor system superior to the weak-mayor system. The centralization of authority in the office of the mayor assures better coordination of the services of city government. One of the chief weaknesses of the strong-mayor system is that conflicts often arise between the mayor and the council because they share policymaking powers. One reason most of the largest cities in the United States use the strong-mayor system is that satisfying the conflicting demands of a wide variety of social groups requires strong political leadership by the chief executive official.

Patronage. In many large cities, under both the strong-mayor and the weak-mayor systems, politicians have built strong political party organizations. The parties maintain their power through *patronage*, in which party workers and contributors receive jobs, building and other contracts, or other benefits. Many urban reformers charge that the patronage system often produces dishonest and inefficient city officials. Some cities have adopted *nonpartisan* elections to try to avoid these problems. In such elections, the candidates for public office do not run on a political party ticket. Some states or individual cities have merit systems for civil service appointments to city jobs.

Commission Form

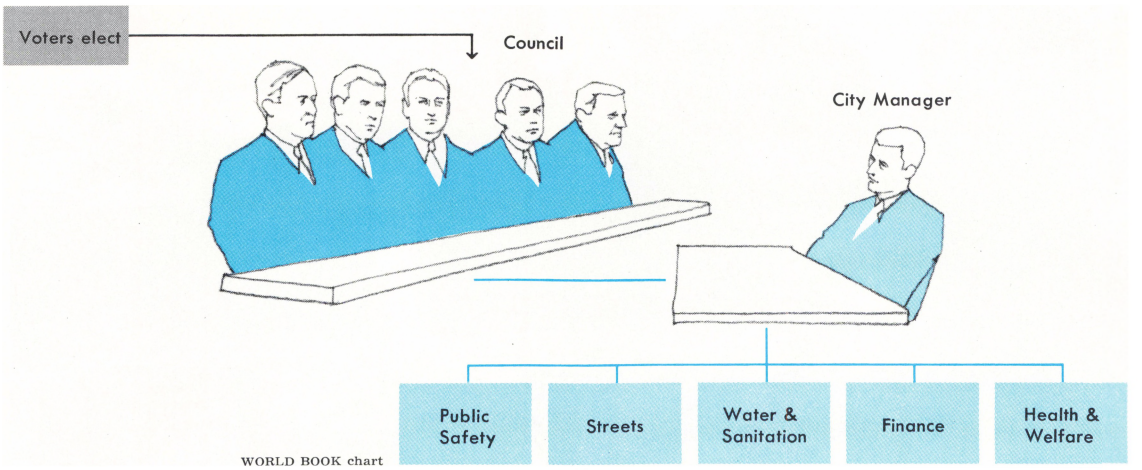
The commission form of government combines legislative and executive authority in an elected group of commissioners. The number of commissioners varies from city to city, but most commissions are made up of five commissioners. Each commissioner heads a city department—such as public works, finance, or public safety—and is separately responsible for the administration of his department. The commission as a body has the power to pass ordinances, impose taxes, distribute funds for city needs, and appoint officials. One of the members may be designated as mayor for ceremonial functions and for presiding over commission meetings. But he has no more formal powers than the others.

The first commission government in the United States was set up in Galveston, Tex., in 1901. The preceding year, a tidal wave and hurricane had destroyed a large part of Galveston, and the city's weak-mayor government could not deal with the emergency. As a result, the state legislature provided for a city government by commission of five persons. The plan was an immediate success and attracted attention throughout the United States. In 1907, Des Moines, Iowa, adopted the commission system and added such features as nonpartisan elections. By 1917, about 500 cities had commission governments. However, many of these cities—including Galveston and Des Moines—later abandoned the commission form.

The chief objection to commission government has been that disagreements among commission members on issues involving more than one department make effective coordination difficult. Also, many commissioners have been poor administrators. Today, about 110 U.S. cities with populations of 5,000 or more have

COUNCIL-MANAGER FORM OF GOVERNMENT

The council determines city policies and appoints a city manager to carry them out. The city manager, in turn, appoints department heads and is responsible for managing all city services.



WORLD BOOK chart

a commission form of government. This is only about 3 per cent of the cities of 5,000 or more persons.

Council-Manager Form

The council-manager form of government is also called the *city manager plan*. Under this form of government, a professional administrator called a *city manager* supervises all municipal affairs. An elected city council hires the city manager. Most councils have from five to nine members. In most cities that use the council-manager form, the councilmen are elected on nonpartisan ballots. The mayor is a member of the council. He is either elected to the office by the people or selected by the other councilmen. The mayor presides at council meetings but seldom has more power than other councilmen. The council is the chief governing body of the city. It determines policies and passes ordinances. The city manager carries out the policies set by the council. The council may dismiss the city manager if it is dissatisfied with his work.

A chief feature of the council-manager plan is the centralization of administrative responsibility. The city manager appoints the heads of all departments and is responsible for managing all city services.

Council-manager government is often said to be highly efficient. It is modeled on the organization of a business firm. The city council corresponds to the board of directors of a corporation, and the city manager to a corporation's general manager. City managers, who have experience and special training in city administration, perform many of the governmental activities. Politics is supposed to play little or no part in their administrative decisions because they are appointed, not elected. However, some scholars believe that city managers lack the ability to handle political conflicts between races, economic groups, or neighborhoods. They also argue that councilmen selected in nonpartisan elections lack political experience and often do not cooperate with one another. In addition, some cities have tended to blame all political weaknesses on the city manager and therefore have had high rates of turnover in managers.

The council-manager plan developed in the United States during the early 1900's. It was planned and promoted by the National Short Ballot Organization, a nonpartisan political group. In 1908, Staunton, Va., hired a general manager to handle its administrative affairs under a mayor-council system. In 1912, Sumter, S.C., became the first city to adopt a complete council-manager government. The first large city to do so was Dayton, Ohio, in 1914. Today, about 1,450 U.S. cities with populations of 5,000 or more use the council-manager plan. This is about 38 per cent of the cities with 5,000 or more persons.

WILLIAM C. HAVARD

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CITY MANAGER. See CITY GOVERNMENT (Council-Manager Form).

CITY OF BROTHERLY LOVE. See PHILADELPHIA.

CITY OF ORANGES. See SALTO.

CITY OF REFUGE NATIONAL HISTORICAL PARK. See NATIONAL PARK SYSTEM (table; picture).

CITY OF ROSES. See MONTEVIDEO (Location and Description); PORTLAND (Ore.).

WORLD BOOK photo, courtesy C. F. Murphy Assoc.

City Planning is the work of many people, including professional city planners, architects, and other specialists. Experts study a model, above, while discussing ways to improve a community.

CITY PLANNING

CITY PLANNING is the process of guiding the development of cities and towns. City planners—the men who direct the process—advise local governments on ways to improve communities. They also advise governments and real estate developers who are planning entirely new communities.

City planners deal chiefly with the physical layout of communities. They make proposals designed to beautify communities and to make life in communities comfortable, enjoyable, and profitable. Their proposals include slum-clearance programs, housing projects to replace run-down housing, recreation areas, modern shopping centers, and improved transportation and parking facilities.

A city planner's day-to-day work chiefly involves improvements in parts of a community. But a planner views a community as a single system in which all the parts are interdependent. He creates a *master plan* (overall plan for the community) and uses it as the basis for his work. This plan shows the entire community both as it is and as the planner believes it should be. A city planner's suggestions for changes in any part of a community must follow the master plan. For example, the plan might restrict the height of buildings in residential areas. The city planner must follow this restriction whenever he designs changes for any residential area within the community.

A city planner tries to predict the future. He attempts to forecast such developments as large increases in population and large losses in industrial activity. His predictions help a government plan for the future.

City planning began with the first cities—about 3500 B.C. Ancient peoples set aside areas for housing, worship, and other activities. They built walls around their communities for protection against enemies. Throughout history, people have done some planning for their communities. But the planning has not kept pace with the tremendous growth of urban communities. Many have become dirty, noisy, overcrowded, and run-down. During the 1900's, governments have greatly increased city planning activities in an attempt to help solve the many problems of cities and towns. For a discussion of these problems, see the WORLD BOOK article on CITY (City Problems).

The Master Plan

The preparation of master plans ranks among the most important duties of a city planner. A master plan, also called a *comprehensive plan*, includes diagrams and models that show a community as it is and as the planner believes it should exist in the future. The plan includes reports and statistical information that support the planner's proposals. A master plan shows how land should be used and how public facilities—such as fire and police stations, parks, schools, and transportation—should be improved or increased.

Preparing the Plan. A professional city planner may consult many other professional experts in preparing a

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master plan. These experts might include architects, economists, educators, engineers, finance specialists, geographers, lawyers, political scientists, statisticians, and specialists in air and water quality. The city planner also seeks advice from nonprofessional people who will be affected by the plan. These people include businessmen, homeowners, and members of citizens groups. Such consultation with people affected by a master plan is called *advocacy planning*. It increased greatly during the mid-1900's.

Many communities—mostly small ones—hire a private planning firm that prepares a master plan and submits it to the local government for approval. In many other communities, an agency of the local government does the planning job. In some of these communities, the mayor or other top executive appoints a city planning commission made up of private citizens and public officials. The commission then appoints a city planning staff, and the staff creates the master plan. The staff is responsible to the commission. In some other communities—especially big cities—the government includes a department of city planning. This department prepares the master plan. The city planner and other department members are responsible to the top executive.

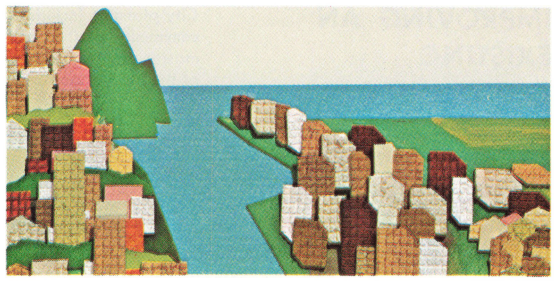
Proposals of the Plan. A master plan aims to make community life more comfortable, enjoyable, and profitable. A good plan separates residential areas from industrial areas. It provides transportation facilities that enable people to get to and from stores, offices, and factories quickly and easily. It also provides enough recreation areas, schools, and shopping facilities.

The major part of a master plan recommends how the community's land should be used. The city planner divides the community into sections. He classifies some sections as residential areas, others as commercial and industrial areas, and the rest as public facility sites. He divides these major sections into smaller districts, each with certain building restrictions. For example, the planner reserves some parts of residential areas for houses only and some for both houses and small apartment buildings. He may propose construction of high-rise apartment buildings in other neighborhoods. The master plan may permit retail trade, wholesale trade, and light manufacturing in some commercial and industrial districts but forbid heavy manufacturing there.

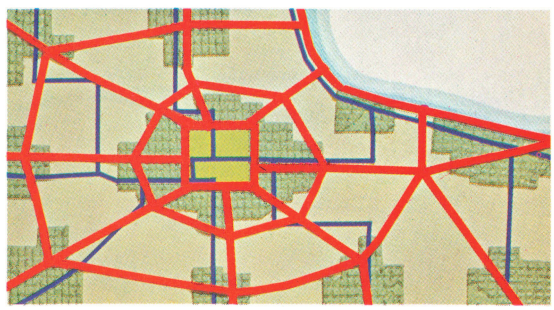
A master plan may suggest ways to improve the appearance of a community. For example, it may propose treelined boulevards, scenic parks, and a new civic center.

The plan may include proposals for major changes in citywide facilities, such as sanitation and transportation systems. It may recommend a more complex sanitary drainage system for heavy manufacturing areas than for residential and commercial districts. It also may call for the widening of streets and the construction of a new expressway to ease travel between residential, commercial, and industrial areas.

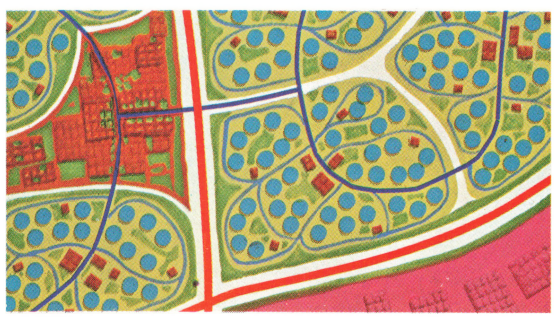
City planners are still chiefly concerned with the physical layout of communities. But in the mid-1900's, many planners also began dealing with economic and social problems. Today, a city plan may include such proposals as job training programs for unskilled work-



A Land Study is essential to the work of a city planner. The planner must work out his plan around such physical features as bodies of water and steep hills.



Transportation ranks among the chief concerns of city planners. A planner's new transportation system, *red lines above*, reaches more of the community than does the old system, *blue lines*.



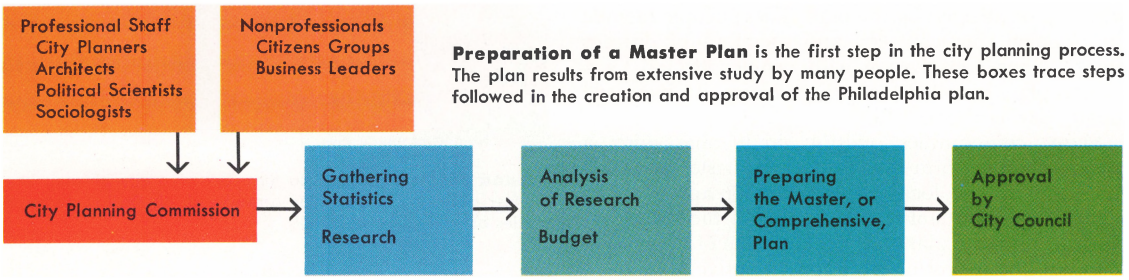
Land-Use Proposals make up the biggest part of a city plan. A good plan separates industrial areas, *pink*, from residential areas, *blue and green*, and provides enough business areas, *orange*.

WORLD BOOK illustrations by George Suyeoka

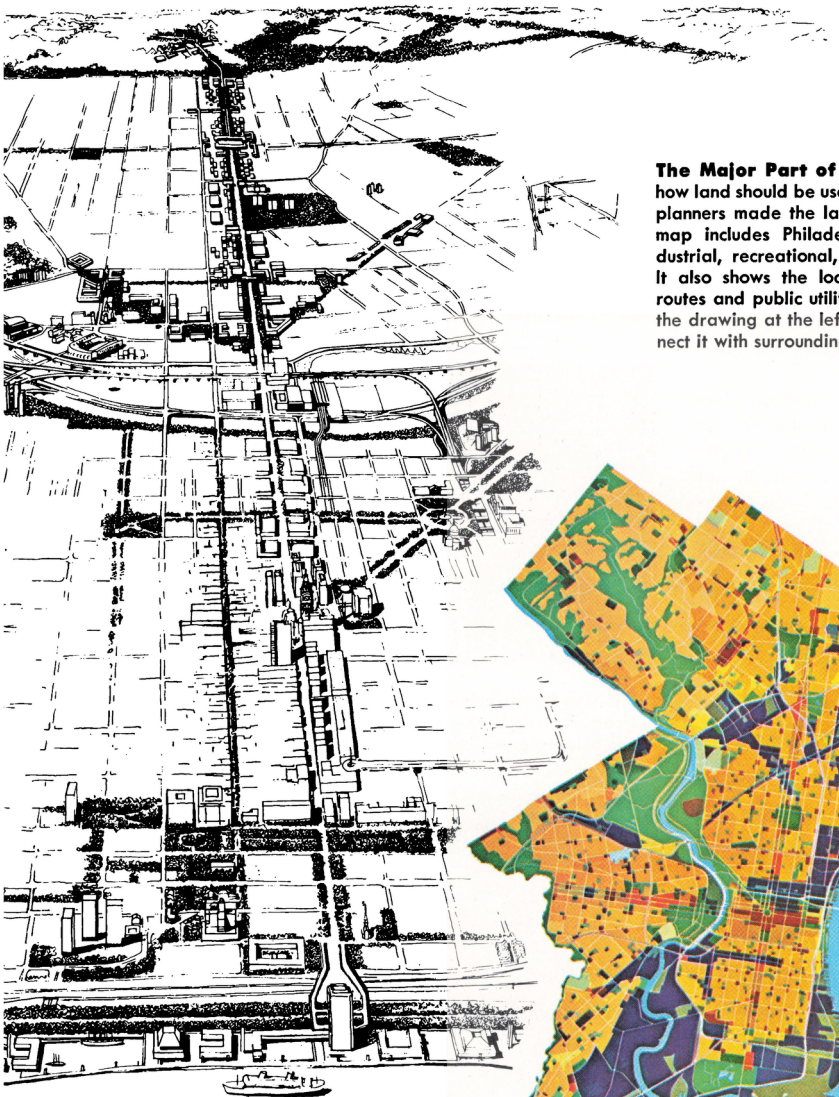
Beautification is one of the goals of city planning. A treelined grassy area, *above*, beautifies a scene while providing open space for people living in closely packed apartment buildings.

IMPROVING AN EXISTING COMMUNITY

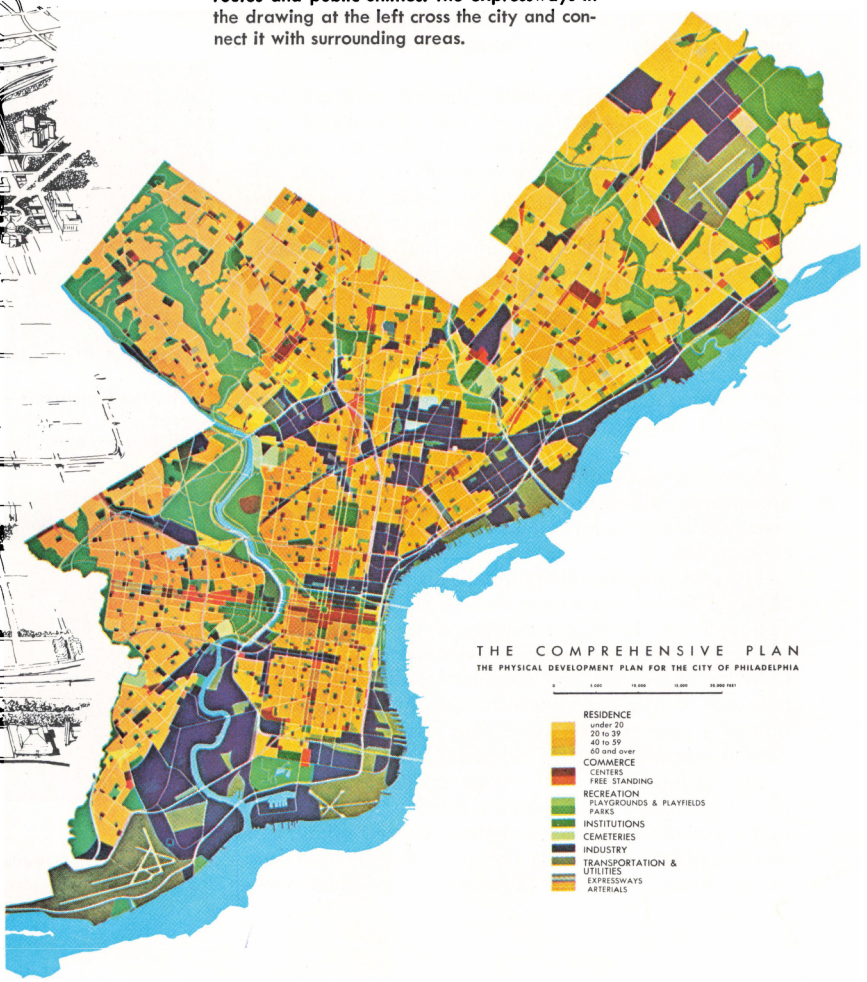
City planning includes the preparation of a master, or comprehensive, plan, which shows a community as it is and as the planner believes it should be. A city planner may revise a master plan while the work of improving a community is in progress. Philadelphia, the subject of the illustrations on these two pages, has an extensive city planning program.



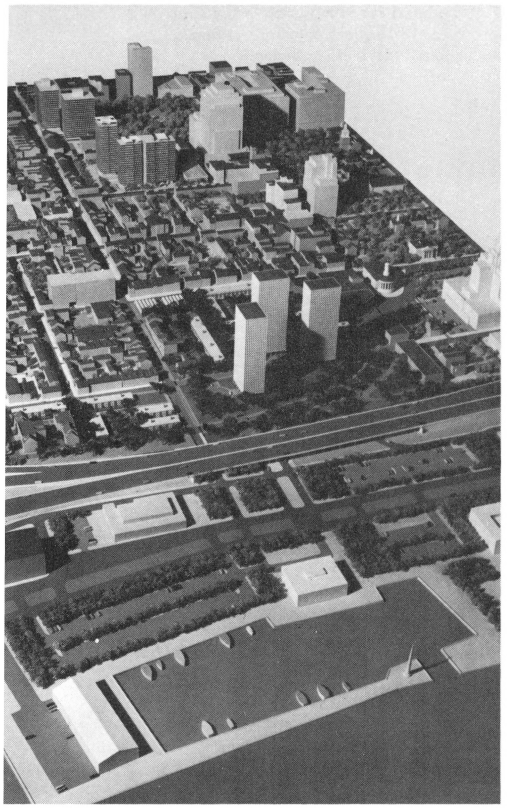
Preparation of a Master Plan is the first step in the city planning process. The plan results from extensive study by many people. These boxes trace steps followed in the creation and approval of the Philadelphia plan.

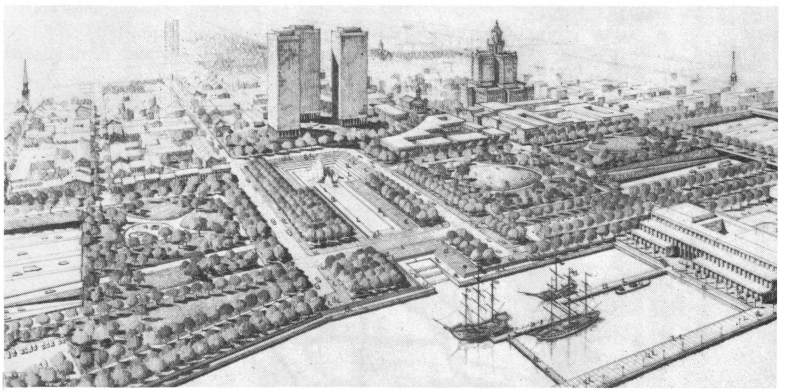


The Major Part of a Master Plan shows how land should be used. The Philadelphia city planners made the land-use map below. The map includes Philadelphia's commercial, industrial, recreational, and residential areas. It also shows the location of transportation routes and public utilities. The expressways in the drawing at the left cross the city and connect it with surrounding areas.



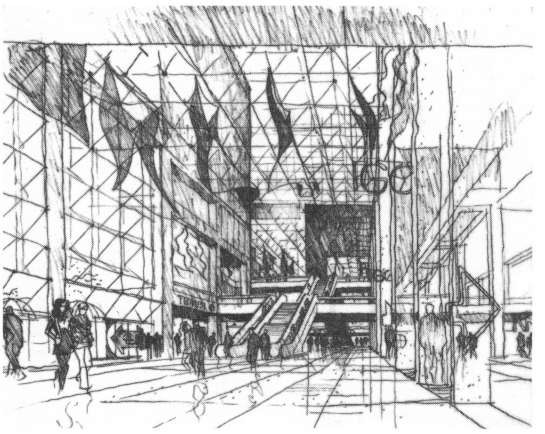
Illustrations courtesy
Philadelphia City Planning Commission





Lawrence Williams, Philadelphia City Planning Commission

Master Plan Revisions. A city planner constantly looks for ways to improve the master plan. A model part of Philadelphia, *left*, shows an expressway above the ground, and also a small harbor. The drawing above reflects revisions in the plan. The expressway runs below the ground, and the harbor is enlarged.



Bower & Fradley, Architects

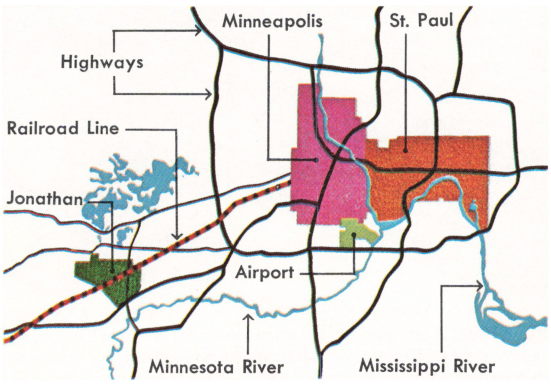
Imaginative Proposals may gain public support for a master plan. A sketch of one such proposal in the Philadelphia plan appears at the right. The sketch shows an enclosed, traffic-free, air-conditioned shopping center for the city's Market Street East development.

Skyphotos, Phila.

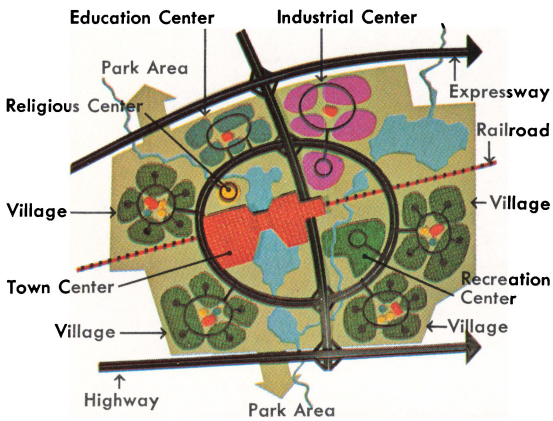
Carrying Out a Master Plan may take many years. Three tall apartment buildings, called the Pei Towers, *center above,* rank among the major completed proposals of the 1960 Philadelphia master plan. Other projects, such as harbor development, are under construction.

DEVELOPING A NEW COMMUNITY

The new town of Jonathan, Minn., was begun in 1967. Scheduled for completion in the late 1980's, Jonathan will have an area of about 13 square miles (34 square kilometers) and a population of about 50,000. These pictures show some of the steps in its planning.



Choosing a Site. The planners chose a site about 25 miles (40 kilometers) from Minneapolis and St. Paul—within easy commuting distance, but away from the crowds and noise of those big cities.



WORLD BOOK illustrations by George Suyeoka

Creating the Plan. A plan of Jonathan, *above*, reflects the latest city planning theories. *Villages* (residential areas) surround the town center and are separated from industry.

WORLD BOOK photo; courtesy Jonathan Development Corp.

Building a Model. The planners of Jonathan built a model to show how the town will look when completed. Part of the model, *above*, shows the town center and one of the villages.

ers, special schooling programs for disadvantaged children, and health services for the needy.

Making the Plan Work

City planners need both money and authority to carry out their programs. They get the money from local and federal governments. But governments get their money by taxing the people, so the money a city planner uses actually comes—indirectly—from the people. Local and federal governments give city planners the authority they need to carry out their plans.

Gaining Support for the Plan. Strong public opposition can cause a government to refuse to act on proposals of a master plan. Proposals may lose support if the public believes they are too costly or would benefit only a small part of the population.

City planners are likely to gain public support with proposals that capture the imagination of the people. Such proposals include the construction of giant buildings, new civic centers, and elevated parking lots and streets. Sometimes a plan gains public support because it includes proposals for solving problems of deep concern to most of the people. A proposal to improve roads may get wide support in a community that constantly has bad traffic jams.

Governmental Authority. To carry out his plan, a city planner must have control over construction and other activities that affect the physical layout of a community. He relies on the government's power of *eminent domain* and its authority to enforce zoning laws, subdivision regulations, and building and housing codes.

The term *eminent domain* describes a government's right to buy private property—even when the owner does not want to sell it. City planners must often rely on this power to get the land they need for major rebuilding projects. In the United States, governments use eminent domain frequently in connection with federally sponsored urban renewal programs. They buy property with buildings on it and then knock down the

buildings. If people live on the property, they are relocated to other residences. The government resells the cleared land to a private developer who builds on it in accordance with the city plan. Or the government itself may keep the land and develop it according to the plan. Governments also must use eminent domain frequently to get the land needed for road-building programs. See EMINENT DOMAIN; URBAN RENEWAL.

Zoning laws designate the kinds of buildings permitted in each part of a community. If a zoning law allows only houses and apartment buildings in a certain area, the city planner knows he can plan that area as completely residential. The zoning law ensures him that the plan will be followed. Zoning laws also allow the planner to regulate sizes of lots, heights of buildings, the number and location of parking and loading areas, and the use of signs.

Other regulations control the subdivision and development of large, open land areas. Private real estate developers often buy large areas and subdivide them into lots. They either sell the empty lots or construct buildings on the lots before selling. Subdivision regulations designate the minimum size of lots and the purposes—residential, commercial, or industrial—for which the developers' land can be used. These regulations also govern other aspects of physical layout. For example, they cover the location and width of streets and the amount of land that must be used for public buildings, schools, and open space.

Building and housing codes regulate the quality of building construction. They also include rules that govern the number of occupants per building and the quality of electric wiring and plumbing.

Building New Communities

The term *city planning* usually refers to attempts to improve existing communities. But it can also mean the development of entirely new communities by governments and private companies. These communities, called *new cities* and *new towns*, differ from suburbs in at least one important way. Most suburbs are designed chiefly as residential communities for people who work in nearby cities. Planners of new communities try to make them fully or partly self-supporting by attracting businesses, thus providing places where the residents can work.

New cities and new towns differ from each other in the degree to which they are self-supporting and in location. Planners of new cities try to ensure that the communities have enough facilities and job opportunities for all the residents. Thus, new cities can be built far from existing cities. In the mid-1900's, the Brazilian government built the city of Brasília far from the country's population center. New cities are extremely costly projects, and Brasília and Canberra, Australia, are among the few ever completed. Developers have not yet built a new city in the United States.

New towns provide jobs for many of their residents, but they must rely on neighboring cities for many jobs. Most new towns are built within commuting distance of a big city.

Great Britain and the Scandinavian countries rank among the leaders in the development of new towns. The governments of these nations provide aid for new town development, including money and the authority to buy the needed land. In the United States, private business is the major source of funds for new town development. But the development of a new town is a slow, costly process, and many private developers are reluctant to take on such a project. Also, developers cannot always get the large sections of land they need for a new town. Only a few new towns have been built in the United States. They include Columbia, Md., and Reston, Va. Construction of Jonathan, Minn., began in the late 1960's.

Criticism of City Planning

Although most people favor the goals of city planning, some criticize the methods used to achieve those goals. Major criticisms include the high cost and government control of city planning and what opponents feel is a wrong emphasis on certain goals.

High Cost is probably the most common criticism of city planning. Critics claim that the cost of carrying out a master plan places too great a burden on the taxpayers. They argue that city planners try to do too much at one time.

Government Control. Some people object to a government's power to force individuals to sell their property and to regulate its use. They view this power as a violation of owners' rights. Some people also object to the city planner's role as a decision maker because the planner is not an elected official.

Wrong Emphasis. Some critics complain that city planners care more about beautifying communities and helping businesses than about solving such social problems as overcrowding and pollution. These critics of city planning also charge that changes made for a community's physical improvement sometimes increase the social problems. For example, a loss of low-cost housing results when luxury apartments replace rundown buildings.

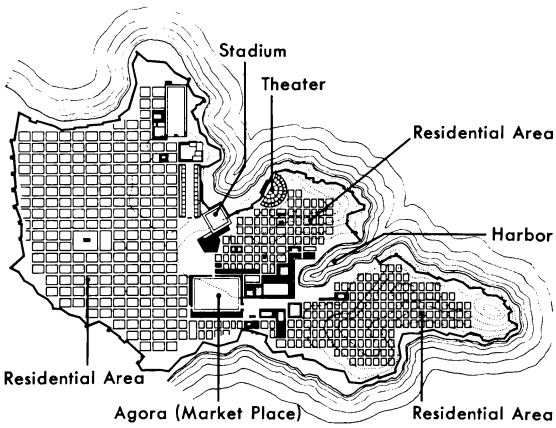
Finnish National Travel Office

Tapiola, Finland, a new town near Helsinki, was built in the mid-1900's. Finland and the other Scandinavian countries and Great Britain are leaders in the development of new towns.

CITY PLANNING

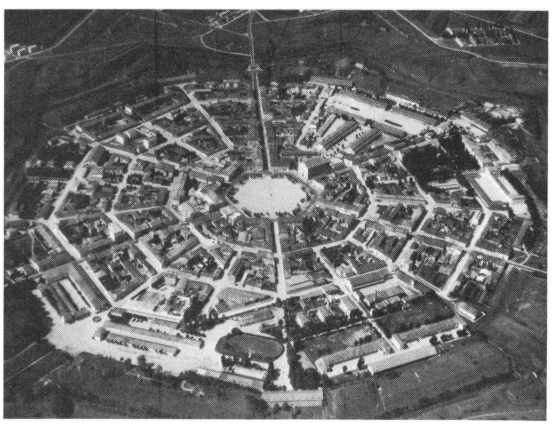
Some people believe that city planners put too much emphasis on the future of cities and towns and not enough on present problems. Yet others criticize city planners who assist in trying to solve day-to-day problems. They believe that planners should concentrate on long-range programs because the planners are the officials most directly concerned with the future development of communities.

Reducing Criticism. City planners need the public's support, and so they work to reduce criticism against their methods. More and more cities are scheduling planning projects farther and farther apart to reduce the financial burden on taxpayers. City planners hope the increased use of advocacy planning—which gives the public a larger role in the planning process—will help reduce criticism. They also hope that more and more people will become convinced of the value of city planning proposals as they see the completed projects.



Adapted from *The Urban Pattern* by Arthur B. Gallion and Simon Eisner, copyright 1950, 1963, by Litton Educational Publishing, Inc., by permission of Van Nostrand Reinhold Company

Miletus, in Ancient Greece, was one of the first cities to have the regular arrangement of city blocks called the *gridiron pattern.* Hippodamus, the man who planned Miletus, is sometimes called the father of city planning.



Fotocielo, Rome

Palmanova, Italy, was planned during the Renaissance by Vincenzo Scamozzi. A huge plaza lies in the center of the city, above. It is an example of the Renaissance practice of creating open spaces in cities to overcome the crowding of earlier days.

History of City Planning

People have done some city planning ever since the first cities appeared about 3500 B.C. This section traces some of the highlights of city planning. For a detailed description of cities and their development through the ages, see CITY.

Ancient Times. People of ancient cities set aside certain areas for meetings, recreation, trade, and worship. Many ancient peoples built walls around their cities to keep invaders out. Groups of public buildings and monuments are among the major examples of city planning in ancient times. Athens and Rome were especially famous for their public buildings and monuments. See ATHENS; GREECE, ANCIENT (illustration: The Center of Athenian Life); ROME (The Ancient City).

Historians believe that Hippodamus, an ancient Greek architect, developed the first systematic theories about city planning. His work included plans for the use of land and the location of streets and buildings in the cities of Miletus and Piraeus.

The Middle Ages. Many peoples built protective walls around their cities during the Middle Ages—from the A.D. 400's to 1500. Population growth caused a number of cities to become overcrowded. Some cities solved this problem by knocking down the walls and rebuilding them farther out. Other cities let the walls stand and built new cities nearby.

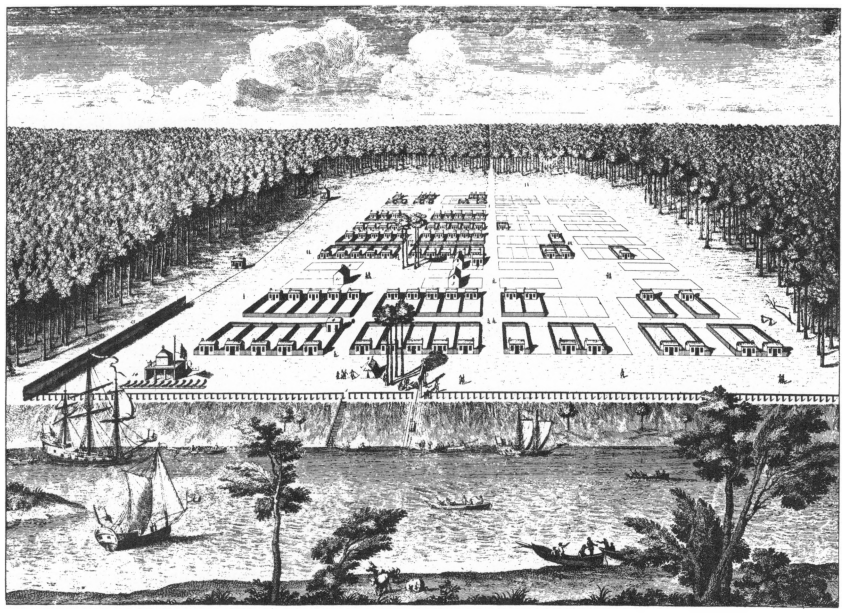
Religion played an important part in medieval European life and was reflected in the planning of many cities. The main church stood in the center of the city and was the biggest and most expensive building.

The Renaissance, a period of great artistic development, began near the end of the Middle Ages and lasted into the 1600's. Several leading artists of the period, including Gian Bernini, Leonardo da Vinci, and Michelangelo, became involved in work to beautify cities.

During the Renaissance and for many years after it, city planners designed parts of cities on a grand scale. They created open spaces to overcome the overcrowding of earlier days. Examples of this trend include the huge plazas in front of the Cathedral of Saint Mark in Venice and Saint Peter's Church in Vatican City. Another is the beautiful palace and gardens at Versailles, near Paris. Perhaps the high point of the trend toward city planning on a grand scale was Georges Eugene Haussmann's plan for Paris in the mid-1800's. Haussmann designed many wide boulevards and plazas and helped make Paris one of the world's most beautiful cities.

In colonial America, most cities and towns were smaller and less elaborate than the European communities. Early planned cities included Charleston, S.C.; Philadelphia; Savannah, Ga.; and Washington, D.C. Washington was probably the most elaborately planned early American city. George Washington hired Pierre Charles L'Enfant, a French architect, to plan it.

The Industrial Revolution of the late 1700's and early 1800's marked the beginning of the factory system of manufacturing. In Europe and North America, the



Savannah, Ga., shown under construction, *right,* was one of the first planned cities in colonial America. Settlers built it according to a plan drawn by William Bull and James Oglethorpe. The colonists cut down trees in the surrounding forest and used the wood to build houses and fences around them. They also encircled the settlement with a fence, shown partially built at the left.

Historic Savannah Foundation

population of many cities increased rapidly as thousands of workers left farms to take manufacturing jobs in cities. Cities became overcrowded, dirty, and noisy. Many people lived in crowded, run-down, unsanitary housing near the factories.

Social reformers began calling on governments to improve city life. They proposed new housing areas with gardens and open spaces and new communities with industry and housing in separate areas. Governments took some steps to regulate the quality of housing and to otherwise improve cities. But the cities continued to grow, and city planning failed to keep pace.

The 1900's. Until the early 1900's, city planning in the United States was largely the responsibility of architects who were hired by private organizations or, in some cases, by governments. The rapid increase in urban problems during the late 1800's forced governments to take a greater part in city planning.

Between 1900 and 1930, many local governments in the United States established city planning commissions and introduced zoning laws. Among the most famous redevelopment plans of the early 1900's was Daniel Burnham's plan for Chicago.

The urban population explosion that followed World War II (1939-1945) caused severe housing shortages, more slums, and heavier traffic than ever. To meet the challenge of growing cities, planning agencies had to expand their programs to provide for new housing projects, parks and recreation areas, and better industrial and commercial districts. The Philadelphia renewal program of the early 1950's was one of the most impressive plans of the postwar period. More recent developments in city planning include programs for establishing metropolitan planning agencies, such as the one for the Greater Toronto area.

Careers in City Planning

A professional city planner needs certain personal and educational qualifications. City planners have a special interest in design, social and economic planning, and industrial development. Most planning positions are available only to people who have a degree in city planning. Many colleges offer this degree.

Job opportunities in city planning are available to persons trained in a number of other fields. These fields include architecture, computer programming, economics, engineering, finance, law, political science, statistics, and sociology.

JACK MELTZER

Related Articles in WORLD BOOK include:

Architecture
Brasília
Building Permit
Burnham, Daniel H.
Canberra
City
City Government
Eminent Domain
Housing
Landscape Architecture
Le Corbusier
L'Enfant, Pierre C.
Model Cities
Urban Renewal

Outline

I. The Master Plan
A. Preparing the Plan
B. Proposals of the Plan
II. Making the Plan Work
A. Gaining Support for the Plan
B. Governmental Authority
III. Building New Communities
IV. Criticism of City Planning
A. High Cost
B. Government Control
C. Wrong Emphasis
D. Reducing Criticism
V. History of City Planning
VI. Careers in City Planning

Questions

What does a master plan for a city include?
Who probably developed the first theories about city planning?
What is the power of *eminent domain?*
Why is public support important to a city planner?
What is *advocacy planning?*
Why are there few new towns in the United States?
Who planned Washington, D.C.?
How do zoning laws help city planners?
What are some criticisms of city planning?
How did the Industrial Revolution increase the need for city planning?

CITY-STATE is a state in which political life and political control center in a single city. The city-state had its fullest development in ancient times. The most famous examples were Athens and Rome. The Athenian state consisted of Athens itself and also the outlying villages of Attica. The free inhabitants of this territory owed allegiance not to Attica but to the city of Athens, and were Athenian citizens. The ancient city-state was like a modern city in territory and a nation in powers.

In the Middle Ages, the Italian cities of Milan, Florence, Genoa, Venice, and Naples rose to power as independent states. The free cities of Germany, including Hamburg, Bremen, and Lübeck, were examples of the city-state in a modified form. PAYSON S. WILD

See also ATHENS (Earliest Times); FREE CITY; GREECE, ANCIENT (The City-State); HITTITE (History); ITALY (Rise of the City-States).

CIUDAD BOLÍVAR, *syoo THAHTH boh LEE vahr* (pop. 98,007), is the commercial outlet for more than half of Venezuela—the southern Orinoco plains and Guiana highlands. It is on the Orinoco River, about 270 miles (435 kilometers) inland from the Atlantic Ocean. For location, see VENEZUELA (color map). Ocean-going cargo ships carry rubber, gold, diamonds, hides, chicle, and tonka beans (used in tobaccos and perfumes) from Ciudad Bolívar. A steel mill and a hydroelectric plant are located nearby. The city was founded in 1764 as Angostura. It was the original home of Angostura Bitters, used in drinks (see BITTERS). W. DONALD BEATTY

CIUDAD DE MALABO, (pop. 37,237), is a seaport and the capital of Equatorial Guinea. It is located on the island of Fernando Póo. The chief export of the city is cacao. The British founded Ciudad de Malabo in the 1820's under the name of Port Clarence. Later it was called Santa Isabel. For location, see EQUATORIAL GUINEA (map).

CIUDAD JUÁREZ. See JUÁREZ.

CIUDAD TRUJILLO. See SANTO DOMINGO.

CIVET is a furry mammal that looks somewhat like a long, slender cat. But a civet has a more pointed snout, a fluffier tail, and shorter legs than a cat. Civets live in Africa, southern Asia, and southern Europe. The spotted skunk, found in most parts of the United States, is sometimes called a civet cat, though it is not actually a civet.

Civets vary in color and size. Their fur may be black, brown, gray, or tan. Most species have dark spots or splotches, and the tail has rings of light and dark fur. A few species have a plain coat or only faint spots. The smallest kind of civet, the *African linsang*, grows about 13 inches (33 centimeters) long, not including its tail. The largest civet, the *binturong* of Southeast Asia, measures as long as 38 inches (97 centimeters). It has a long, shaggy, blackish-gray coat. This animal uses its muscular tail to grasp branches and to steady itself while climbing in trees.

Most kinds of civets climb well and spend much time in trees. Some sleep in tree holes or among tangled branches. A few species live mostly on the ground and dig burrows. Civets move about chiefly at night. They live alone, except for females and their young.

Most civets eat birds, frogs, insects, rodents, and small reptiles. Excellent hearing, sight, and smell help civets hunt their prey. Civets also eat fruit and other parts of plants and the eggs of various animals. The binturong and some African and Asian species called *palm civets* feed chiefly on plants.

Some civets live near farmhouses and in villages. They help people by feeding on mice and rats, but they also may eat chickens and raid fruit orchards. Some families in Africa and southern Europe keep civets called *genets* as pets to rid their homes of rodents.

Most kinds of civets spray their enemies with a foul-smelling liquid from a gland near the base of the tail. Perfume manufacturers use the liquid, called *civet musk*, from several species, especially the *African civet*. Civet musk makes the odor of perfume last longer.

Scientific Classification. Civets belong to the civet family, *Viverridae*. The binturong is genus *Arctictis*, species *A. binturong*. CLYDE A. HILL

See also ICHNEUMON; MONGOOSE.

CIVIC CENTER is a group of public buildings and landscaped spaces in a city. The center may include an auditorium, a library, a band shell, shops, hotels, and government and office buildings.

The idea of such a community gathering place developed in ancient Greece. The Forum in Rome was a center of politics, business, and religion. Medieval towns

Warren Garst, Tom Stack & Assoc.

The Civet has a long, slender body and looks somewhat like a cat. One kind of civet, the genet, *left*, has a loosely jointed body. This animal can move through any opening large enough for its head to enter.

had public squares for religious and other activities. Today, the great size of cities increases the need for civic centers. BERNARD LEMANN

CIVICS is a course of study that teaches the duties and rights of citizenship. It considers the functions, structures, and some of the problems of political, social, and economic institutions on local, state, national, and international levels.

In addition to formal studies in civics, some teachers encourage student participation in such activities as student councils and clubs, and school papers. Here, students learn cooperation by working with others. Some schools encourage direct student participation in community projects. PAUL R. HANNA

Related Articles. See the Government section in the state and province articles. See also:

Canada, Government of
Citizenship
City Government
Community
Democracy (Making Democracy Work)
Government
Human Relations
International Relations
Local Government
State Government
United States, Government of
World

CIVIL AERONAUTICS ADMINISTRATION. See FEDERAL AVIATION ADMINISTRATION.

CIVIL AERONAUTICS BOARD (CAB) is an independent regulatory agency of the United States government. The President appoints its five members with the approval of the Senate. The CAB regulates the economic phases of U.S. domestic and international airline activities. The board issues certificates to U.S. airlines for domestic and international service and issues permits to foreign airlines for flights to the United States. It sets air fares and service mail rates and is also responsible for promoting air travel. It was the first regulatory agency to establish a consumer affairs office.

The Civil Aeronautics Board aids in establishing and developing international air transportation in cooperation with the Department of State. It cooperates in forming international standards for air operations. Congress established the Civil Aeronautics Authority in 1938. In 1940, the agency was renamed the Civil Aeronautics Board. Critically reviewed by the CIVIL AERONAUTICS BOARD

CIVIL AIR PATROL (CAP) is a civilian auxiliary of the United States Air Force. It operates under the Air Force Continental Air Command, but it is not a federal government agency. It has about 85,000 adult and teen-age members who serve without pay.

The CAP has about 48,000 cadets who are from 13 to 21 years old. It has about 37,000 senior members over 21 years old. Members are organized into 52 wings and about 2,300 local groups, squadrons, and flights. Members wear uniforms similar to U.S. Air Force uniforms, but they wear different insignia and badges. The CAP has more than 11,000 FAA-licensed pilots and almost 5,000 aircraft. It operates a radio network that includes more than 21,000 fixed, mobile, and airborne stations.

The CAP participates in search and rescue missions authorized by the air force. In the 1960's, the CAP annually accounted for over half the search and rescue missions flown in the United States. CAP pilots fly thousands of hours each year, searching for lost planes and doing relief work during disasters.

More than 600 high schools offer CAP aerospace education courses. The CAP also conducts many workshops and institutes for teachers. It publishes a complete series of aerospace education and training textbooks. The CAP awards scholarships and educational grants to selected members annually. It participates in an International Air Cadet Exchange program with 22 other countries, and offers cadets training in aerospace developments through courses conducted at air force bases.

The Civil Air Patrol was established in 1941 in the Office of Civilian Defense. It organized and directed the activities of volunteer civilian airmen using their own aircraft and equipment for wartime tasks. The CAP was transferred to the War Department in 1943 as an auxiliary of the Army Air Forces. In 1946, Congress chartered it as a nonprofit private corporation. The CAP became a civilian auxiliary of the U.S. Air Force in 1948. Civil Air Patrol headquarters is at Maxwell Air Force Base, Ala. 36112.

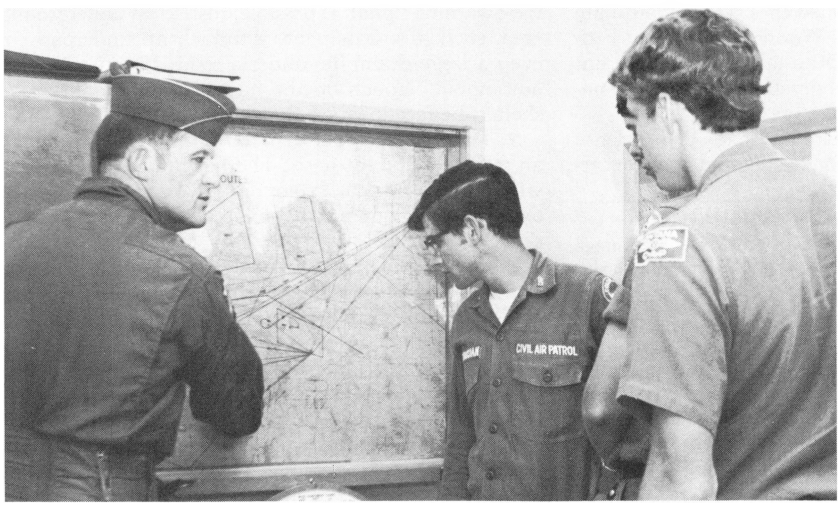
Critically reviewed by the CIVIL AIR PATROL

CIVIL AND DEFENSE MOBILIZATION, OFFICE OF (OCDM). See NATIONAL DEFENSE (History).

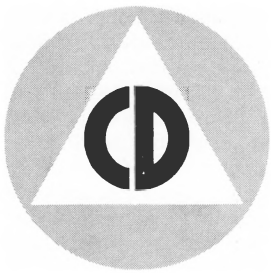
CIVIL CODE. See CODE NAPOLÉON.

CIVIL DEATH. See DEATH, CIVIL.

Civil Air Patrol—USAF



Civil Air Patrol Cadets receive aerospace training from United States Air Force personnel. Cadets wear uniforms similar to Air Force uniforms. The Civil Air Patrol emblem is shown above.



Chicago Civil Defense Corps

A Warning Siren signals an enemy attack or a natural disaster, such as a flood or tornado. After a warning, TV and radio provide information about the danger and how to avoid it.

CIVIL DEFENSE is a nonmilitary program for saving lives and property if an enemy attacks a country. Civil defense also may include programs for protecting people threatened by such disasters as earthquakes, floods, hurricanes, tornadoes, and major explosions and fires.

In the United States, civil defense is a joint responsibility of the federal, state, and local governments. The federal and state agencies provide guidance and assistance, and the local agencies develop and carry out civil defense plans for their communities. When disaster strikes, directors of civil defense agencies coordinate efforts to save lives and property. Nationwide civil defense programs are conducted by the governments of many other nations, including Canada, Denmark, Norway, Russia, Sweden, and Switzerland.

The first U.S. civil defense agency, the Council of National Defense, was established in 1916, the year before the United States entered World War I. This council, which consisted of several members of the President's Cabinet, directed the nation's civil defense efforts before and during the war. State and local governments also set up civilian mobilization councils. The Office of Civilian Defense was established in 1941 to coordinate civil defense activities during World War II. The Federal Civil Defense Act of 1950 established the present civil defense system, which is designed to meet the nation's needs during the nuclear age.

The threat of modern warfare has made civil defense more difficult than ever before. A nation may be attacked with biological, chemical, and nuclear weapons as well as with standard weapons. A missile can carry nuclear explosives 6,000 miles (9,700 kilometers) in 25 minutes, and so people may have little warning of an attack.

People can protect themselves from an enemy attack or a natural disaster in one of two ways. They may leave the endangered area if they have time to do so. If they do not have enough time, they may simply rush to the safest nearby place. Every person should be prepared for a disaster by knowing the civil defense warning signals and what they mean. People should also know (1) their community's plan for emergency action, (2) how to obtain official information and instructions during and after a disaster, and (3) skills for surviving a natural disaster or nuclear attack. For example, at least one member of each household should learn first aid and how to protect people from radiation.

What to Do in a Nuclear Attack

You can increase your chances of surviving a nuclear attack by following these six guidelines:

1. Take Cover immediately when you hear the attack warning signal. If possible, rush to an underground area, such as a basement, a tunnel, an underpass, or even a large drainpipe under a road. If you are in an automobile, crouch on the floor. If you cannot reach shelter, lie facedown on the ground.

2. Drop to the Floor or Ground promptly if you see an extremely bright flash. The flash might be the first warning of a nuclear explosion. If you are inside, keep away from windows. Stay near a wall or under a bed, a desk, or a table.

3. Cover Your Eyes instantly with your arm if you know an attack is about to occur. The flash of a nuclear explosion can blind a person temporarily or even permanently.

4. Do Not Rush Outside after a nuclear blast. Emergency workers would use loudspeakers or radio broadcasts to tell you when it is safe to go outside.

5. Move to a Place That Provides Protection from Radiation as soon as immediate danger from the blast has passed.

CIVIL DEFENSE WARNING SIGNALS

Civil defense agencies of the United States use the attack warning signal or the alert signal to warn of danger. Both signals last for three to five minutes.

The Attack Warning Signal consists of a wavering sound from a siren or a series of short blasts on a factory whistle or other device. This signal means that an enemy has attacked the country and so people should immediately act to protect themselves.

The Alert Signal is a long, steady sound from a siren, whistle, or other device. It means that radio and television stations will immediately broadcast information about a peacetime disaster, such as a flood or tornado.

6. Do Not Spread Rumors that could cause people to panic or to take unnecessary risks. Follow the instructions given by local authorities. Nuclear weapons are the most destructive known, but they cannot blow the earth apart or kill everyone by radiation. Countless lives can be saved by the use of correct civil defense procedures.

Surviving Radiation Danger

A survivor of a nuclear attack would still be endangered by fallout. These particles of radioactive material settle to the earth following a nuclear explosion. They produce radiation that can cause sickness or even death. The wind may carry radioactive material hundreds of miles or kilometers. Most fallout reaches the ground in a few minutes or within several hours. See FALLOUT.

You can protect yourself from fallout by staying in a building made of thick, heavy material that blocks radiation. Any such structure can be used as a fallout shelter. Such underground areas as caves, mines, and tunnels also provide protection from radiation.

The U.S. government has designated thousands of buildings and some underground areas to serve as public fallout shelters. Most public fallout shelters are in cities, and many rural and suburban areas do not have enough shelters. Some families have their own home fallout shelter. Government civil defense manuals provide plans for home shelters and tell how to build an emergency shelter in a few hours. See FALLOUT SHELTER.

If possible after an attack, everything you eat and drink should be free from fallout. Food and beverages from cupboards and covered containers would probably be free of radioactive particles. Most well water would be safe to drink, and some drinkable water could be drained from water pipes and hot-water heaters. People could clean fallout particles from such smooth, hard foods as apples. Food and water that might contain small amounts of fallout may be used if no other supplies are available. Such food and water would probably be safe after about three days because fallout loses much radioactivity in that time.

In most areas, people would have to stay in a fallout shelter for only two or three days after a nuclear attack. They could then go outside safely, at least for short periods. In areas of heavy fallout, they probably could leave a shelter after a week or two to perform emergency tasks. Such tasks would include obtaining food or medical care. Broadcasts would inform the public about radiation in the area.

Civil Defense in the United States

Federal and state agencies coordinate and promote overall emergency planning. Local officials are directly responsible for helping people affected by a disaster. In major emergencies, local governments may obtain assistance from state and federal agencies.

Federal Programs. The Defense Civil Preparedness Agency (DCPA) coordinates the nation's nonmilitary preparations to handle the effects of an enemy attack. The DCPA, an agency of the Department of Defense, provides guidance and assistance on civil defense to agencies of the states and of U.S. possessions. The DCPA also works with business, industry, and national organizations to improve civil defense preparedness, and advises the public on how to survive a nuclear attack.

DCPA programs have resulted in the establishment of a nationwide system of public fallout shelters and several thousand emergency operating centers in federal, state, and local facilities. The centers are protected places where key officials can meet to direct emergency operations.

The DCPA is responsible for the operation, by the U.S. Army, of the federal portion of warning and emergency communications systems. The warning system would be used to alert federal, state, and local agencies of an enemy attack. These agencies, in turn, would alert emergency workers. Local officials would operate sirens, whistles, and other devices to warn the public. Radio and television broadcasts would provide emergency information and instructions.

The DCPA has established ways to measure and report radiation and to estimate damage from an attack. These activities would help government officials direct emergency operations and plan the use of the nation's remaining resources.

Other federal agencies share in civil defense. For example, the Department of Agriculture works to prepare residents of rural areas to deal with an enemy attack or a nonmilitary disaster. The Office of Preparedness in the General Services Administration helps prepare federal agencies to operate in such an emergency. The Federal Disaster Assistance Administration, an agency of the Department of Housing and Urban Development, coordinates government aid to areas stricken by a major peacetime disaster. The military services provide various kinds of assistance to civil government in disaster situations.

State and Local Programs. Every state has a civil defense director. Each state provides assistance to the civil defense agencies of its cities and counties and sees to it that federal aid reaches local agencies.

Most city and county governments also have a civil defense director. This official coordinates preparations by various departments of the local government and by individuals and private organizations. Firemen, police officers, and other local government personnel would have the chief responsibility for saving lives and property in case of disaster. They would obtain help from such skilled persons as physicians and operators of radiation detection equipment.

Emergency Planning in Canada

A national agency called Emergency Planning Canada (EPC) is responsible for Canadian civil defense. EPC coordinates emergency planning by all federal agencies and departments. It also helps cities, provinces, and territories plan for major emergencies. The agency trains personnel at the Canadian Emergency Measures College in Arnprior, Ont.

Critically reviewed by the DEFENSE CIVIL PREPAREDNESS AGENCY

Related Articles in WORLD BOOK include:

Geiger Counter
Guided Missile
Hydrogen Bomb
National Defense
Radiation
Radioactivity

CIVIL DISOBEDIENCE

CIVIL DISOBEDIENCE is the deliberate and public refusal to obey a law. Some persons use civil disobedience as a form of protest to attract attention to what they consider unjust or unconstitutional laws or policies. They hope their actions will move other people to correct the injustices. Other persons regard civil disobedience as a matter of individual religious or moral conviction. They refuse to obey laws that they believe violate their personal principles.

Most lawbreakers try to escape punishment. On the other hand—at least in theory—a person who practices civil disobedience accepts willingly his punishment for breaking the law. He thus demonstrates his deep concern about the situation he is protesting.

Many lawbreakers do not hesitate to use violence. But most acts of civil disobedience are nonviolent. Civil disobedience is usually distinguished from riot, rebellion, revolution, and other types of violent opposition to law and authority.

Is Civil Disobedience Ever Justified? Throughout history, there has been widespread disagreement concerning the use of civil disobedience in a society based on law and order. Some persons claim that every citizen has the obligation to disobey laws he considers basically unjust. They point out that such law-breaking may be the best way to test the constitutionality of a law. Some defend civil disobedience by pointing to Nazi Germany's laws calling for extermination of Jews and certain other groups.

Other persons claim that it is never right to break a law deliberately. They argue that defiance of any law leads to contempt for other laws. Any act of civil disobedience, they believe, weakens society and may lead to violence and *anarchy* (no government or law).

Many persons approve civil disobedience only in extreme circumstances, and then only if it is nonviolent. But they point out that injustices can usually be corrected legally through democratic processes. For example, free elections give people a chance to choose their leaders and express their views on various issues. Various constitutional provisions also protect the right of dissent.

History of Civil Disobedience. Men have practiced civil disobedience for hundreds of years. When the disciples of Jesus Christ were ordered by the state to stop their teachings, they replied that they would obey God rather than men. In the A.D. 1200's, the Christian theologian Saint Thomas Aquinas argued that men must disobey earthly rulers when the laws of the state disagree with the laws of nature, or God.

During the 1600's and 1700's, certain religious sects became known for civil disobedience. For example, the Quakers in colonial America refused to pay taxes for military purposes because they disapproved of war. In the 1850's, abolitionists refused to obey the Fugitive Slave Law, which provided for the return of runaway slaves to the South.

The American writer Henry David Thoreau was one of the most influential spokesmen for civil disobedience. In 1846, he spent a night in jail for refusing to pay taxes. He argued that he did not owe allegiance to a government that captured runaway slaves and waged war on Mexico to expand its area of slavery. In his essay "On the Duty of Civil Disobedience" (1849), Thoreau declared that men should refuse to obey any law they believe is unjust.

Thoreau's essay strongly influenced Mohandas K. Gandhi of India. Led by Gandhi, the Indian people used such nonviolent acts as strikes and protest marches to free themselves of British rule. They gained independence in 1947.

In the United States, during the 1950's and 1960's, Martin Luther King, Jr., and other civil rights workers deliberately violated Southern segregation laws as a means of fighting racial injustice. In the North, black people used civil disobedience to press their demands for open-housing laws and equal employment opportunities. Many opponents of the Vietnam War (1957-1975) committed various illegal acts in attempts to change U.S. policy. Some refused to pay their taxes. Others refused to register for the draft. LEON F. LITWACK

See also GANDHI, MOHANDAS K.; INDIA (Gandhi's Leadership); KING, MARTIN LUTHER, JR. (A Decade of Success); THOREAU, HENRY DAVID (His Beliefs and Works).

CIVIL ENGINEERING. See ENGINEERING (Main Branches); CONSERVATION (Careers in Conservation); SURVEYING (Careers in Surveying).

CIVIL LAW is a term with several meanings. The term is often used to describe the rules of private law and to set them apart from the rules of criminal law. When used in this way, civil law covers such matters as contracts, ownership of property, and payment for personal injury. Criminal law deals with actions that are harmful to society.

The term *civil law* can also mean the law of most European countries, as opposed to the *common law* of Great Britain and every state of the United States except Louisiana. Under this type of civil law, *codes* (sets of rules) approved by legislatures are the primary sources used by judges to decide cases. Under common law, judges base their decisions chiefly on previous court decisions in similar cases. See COMMON LAW; LOUISIANA (Courts).

Originally, civil law referred to the code of laws collected by the Roman emperor Justinian in the A.D. 500's. These laws were used to govern the Roman Empire. A new civil law became popular in most of Europe after it took effect in France in 1804. This law, called the *Code Napoléon* or *Code Civil*, combined the Roman law and the law of northern France. This civil law is the basis of the present law in Quebec, Mexico, and some South American nations. In the United States, there has been much interest in arranging some existing laws into codes. Examples include the law of business and the law of crimes. ROBERT E. SULLIVAN

Related Articles in WORLD BOOK include:

Code Napoléon
Common Law
Contract
Court
Damages
Equity
Fraud
Justinian Code
Law (Private Law; Modern European Law)
Negligence
Nuisance
Suit
Tort
Trespass

CIVIL LIBERTIES. See CIVIL RIGHTS.

CIVIL LIBERTIES UNION, AMERICAN. See AMERICAN CIVIL LIBERTIES UNION.

CIVIL RIGHTS are the freedoms and rights that a person may have as a member of a community, state, or nation. Civil rights include freedom of speech, of the press, and of religion. Among others are the right to own property, and to receive fair and equal treatment from government, other persons, and private groups.

In democratic countries, a person's civil rights are protected by law and custom. The constitutions of many democracies have *bills of rights* that describe basic liberties and rights. Courts of law decide whether a person's civil rights have been violated. The courts also determine the limits of civil rights, so that people do not use their freedoms to violate the rights of others.

In many nondemocratic countries, the government claims to respect and guarantee civil rights. But in most of these countries, such claims differ greatly from the actual conditions. In most Communist countries, for example, the people are denied such basic rights as freedom of speech and of the press. Yet their constitutions guarantee these rights.

Some people draw sharp distinctions between *civil liberties* and *civil rights*. They regard civil liberties as guarantees to a person against government interference. They think of civil rights as guarantees of equal treatment for all persons. For example, civil liberties would include freedom from government interference with a person's right to free speech. Civil rights would include the right of all people to receive equal protection of the law. Civil rights often refers to the condition and treatment of minority groups. This is especially true in the United States. In this article, the term *civil rights* refers to both civil liberties and civil rights.

Limits of Civil Rights

All civil rights have limits, even in democratic countries. For example, a person may be denied freedom of speech in a democracy if it can clearly be shown that his speech might lead to the overthrow of the government. A person may not use civil rights to justify actions that might seriously harm the health, welfare, safety, or morals of others. In 1919, U.S. Supreme Court Justice Oliver Wendell Holmes, Jr., wrote: "The most stringent protection of free speech would not protect a man in falsely shouting fire in a theatre and causing a panic."

A person may be denied a civil right if he uses that right to violate other people's rights. Freedom of expression, for example, does not permit a man to tell lies that ruin another person's reputation. A person's right to do what he chooses with his property may not allow him legally to refuse to sell it to a person of a certain race or religion. The property owner would be denying the other person equal freedom of choice.

The specific limits of civil rights vary with the times. In time of war, a government may restrict personal freedoms to safeguard the country. Changing social and economic conditions also cause changes in the importance that people give certain rights. During the late 1800's, most people in the United States considered property rights more important than personal freedoms. But during the 1900's, most Americans have shown greater concern for personal freedoms and equality of opportunity.

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Civil Rights in the United States

The United States Constitution describes the basic civil rights of American citizens. The first 10 amendments to the Constitution are usually regarded as the U.S. Bill of Rights. However, civil rights are also mentioned in the main body of the Constitution and in later amendments. Each state constitution also has a bill or declaration of rights. Since the mid-1950's, the federal, state, and local governments have passed several civil rights laws. But it has been the courts—especially the Supreme Court—that have probably done the most to define civil rights. When Americans raise questions about the extent and limits of civil rights, they turn to the Supreme Court's decisions for the answers.

For a detailed description of the constitutional rights of Americans, see CONSTITUTION OF THE UNITED STATES. For information on the Supreme Court's part in protecting civil rights, see SUPREME COURT OF THE UNITED STATES (Civil Rights and Liberties).

The First Amendment is the basis of the democratic process in the United States. The First Amendment forbids Congress to pass laws restricting freedom of speech, of the press, of peaceful assembly, or of petition. Many people consider freedom of speech the most important freedom and the foundation of all other freedoms. The First Amendment also forbids Congress to pass laws establishing a state religion or prohibiting religious freedom. The Supreme Court has ruled that the 14th Amendment makes the guarantees of the 1st Amendment apply to the state governments.

Due Process. Many parts of the Constitution, congressional and state laws, and court decisions protect the rights of persons accused of crime. These protections reflect a basic principle in the American legal system. This principle, called *due process of law*, requires the government to treat people fairly. The 5th and 14th amendments forbid the government from depriving a person of life, liberty, or property "without due process of law."

Various statements in the Constitution guarantee due process. For example, the Constitution forbids the government from suspending the *writ of habeas corpus*. This right protects citizens against arrest and detention without good reason. Neither Congress nor the states may pass *bills of attainder*. Such bills declare a person guilty of a crime and take away his property and civil rights without a trial. The Constitution also prohibits *ex post facto laws*. Such laws make a particular act a crime, and punish even those persons who committed the act before it was a crime.

Due process of law also includes court procedures that protect persons accused of wrongdoing. For example, a person may not be brought to trial for a major federal crime unless a grand jury has first decided that enough evidence exists against him. Persons may not be tried twice for the same crime, and they may not be forced to testify against themselves. A person accused of a crime must be informed of his constitutional rights. He also must be informed of the charges against him. He may demand a jury trial, which must be held soon after

the charges are filed. If he cannot afford a lawyer and wants one, the government must provide one.

The person on trial may cross-examine his accusers and may force witnesses to testify. Persons accused of crimes must not be required to pay excessive bail. Those convicted of crimes must not be fined excessively nor made to suffer cruel or unusual punishment.

Other Constitutional Guarantees. The Constitution provides for the security of people and their property. The government may not conduct "unreasonable searches and seizures" of persons or property. It may not take a person's property without due process of law. If the government takes private property for public use, it must pay the owner a fair price.

The Constitution forbids the states to pass laws interfering with contracts made between persons or groups. Each state must recognize the legislative acts, public records, and court decisions of other states. A state must extend its legal protections to the citizen of any other state while he is within its jurisdiction.

Protecting the Rights of Minorities. The United States has many minority groups. These minorities include Negroes, Jews, Orientals, European immigrants, Spanish-speaking Americans, and American Indians. Members of these groups often have not had an equal chance for economic, political, or social advancement. Members of some minority groups have been denied the right to vote. Many persons have been discriminated against in housing, education, and employment, and have been denied equal access to restaurants, hotels, and other public accommodations and facilities. A main goal has been to eliminate such discrimination and guarantee equal rights and opportunities for all people.

The Struggle for Negroes' Rights. Negroes, who make up the largest minority group in the United States, have been denied their full civil rights more than any other minority group.

Negro Americans made significant gains in their struggle for equal rights during *Reconstruction*, the 12-year period after the Civil War. The 13th Amendment, adopted in 1865, abolished slavery in the United States. In 1868, the 14th Amendment made the former slaves citizens. The 15th Amendment, which became law in 1870, prohibited the states from denying people the right to vote because of their race. It also provided that the states must grant all persons within their jurisdiction "equal protection of the laws." During Reconstruction, Congress passed several laws to protect Negroes' civil rights. See RECONSTRUCTION.

During the late 1870's, white Americans increasingly disregarded the newly won rights of Negroes. The government itself contributed greatly to denying Negroes their rights. In 1883, the Supreme Court ruled that congressional acts to prevent racial discrimination by private persons were unconstitutional. In 1896, in the case of *Plessy v. Ferguson*, the Supreme Court upheld a Louisiana law requiring separate but equal accommodations for Negroes and whites in railroad cars. For over 50 years, many Southern states used the "separate but equal" rule established in this case to segregate the races in public schools, and in transportation, recreation, and dining facilities. Many states also used literacy tests, poll taxes, and other means to deprive Negroes of their voting rights. See VOTING (Restrictions).

Since the 1930's, Negroes have had fairer hearings on civil rights cases in the federal courts. The high point came in 1954 in *Brown v. Board of Education of Topeka*. In this case, the Supreme Court ruled that segregation in public schools is unconstitutional. In time, this decision broke down the "separate but equal" principle.

In 1955, the Supreme Court ordered that public school desegregation be carried out "with all deliberate speed." But many Southern school districts continued segregated schools. In 1969, the court departed from its "all deliberate speed" doctrine and ordered desegregation of all school systems "at once."

In 1957, Congress passed the first federal civil rights law since Reconstruction. The Civil Rights Act of 1957 set up the Commission on Civil Rights to investigate charges of denial of civil rights. It also created the Civil Rights Division in the Department of Justice to enforce federal civil rights laws and regulations.

During the 1960's, Negroes' voting rights received increased protection. The Civil Rights Act of 1960 provided for the appointment of referees to help Negroes register to vote. The 24th Amendment, adopted in 1964, barred poll taxes in federal elections. The Voting Rights Act of 1965 outlawed literacy tests in many Southern states. A 1970 law made literacy tests illegal in all the states. In 1966, the Supreme Court prohibited poll taxes in state and local elections.

The Civil Rights Act of 1964 was the strongest civil rights bill in U.S. history. It ordered restaurants, hotels, and other businesses that serve the general public to serve all persons without regard to race, color, religion, or national origin. It also barred discrimination by employers and unions, and established the Equal Employment Opportunity Commission to enforce fair employment practices. In addition, the act provided for a cutoff of federal funds from any program or activity that allowed racial discrimination.

The Civil Rights Act of 1968 aimed chiefly at ending discrimination in the sale or rental of housing. Also in 1968, the Supreme Court ruled that a federal law passed in 1866 prohibits racial discrimination in the sale or rental of all housing.

Civil Rights in Canada

The governments of Canada and of the United States apply the same broad principles in dealing with civil rights problems. Generally, Canadian courts have protected individual liberties, and most of the provinces have civil rights laws similar to those in the United States. In 1960, Canada's Parliament passed an act establishing the Canadian Bill of Rights. The bill is similar to the United States Bill of Rights. It guarantees the same basic freedoms and most of the same protections of judicial processes.

As in the United States, the main civil rights problems in Canada involve assuring equal rights for members of minority groups. In the past, Canadian Eskimos and Indians were sometimes denied their full civil rights. French Canadians of the province of Quebec have long struggled against what they consider discrimination by Canada's English-speaking majority. Many French Canadians claim they have been denied jobs in government and industry because they speak French rather than English. The French Canadians

fear that if they give up the French language, they will lose their national identity, culture, and customs.

Development of Civil Rights

Natural Law. The idea that people have certain rights that cannot be taken away probably began thousands of years ago with the theory of natural law. This theory states that a natural order exists in the universe because all things are created by nature, or God. Everything has its own qualities and is subject to the rules of nature to achieve its full potential. According to this theory, anything that detracts from man's human qualities, or prevents their full achievement, violates the laws of nature.

The ancient Greek philosophers and the writers of the Old Testament stressed that there is a higher law than man's law. In the first century B.C., the Roman philosopher Cicero insisted that this higher (natural) law is universal and can be discovered through human reason. This idea led to the belief that governmental power has limits, and that men and governments everywhere are bound by natural law.

Some of the most historic English legal documents are based on the principles of natural law. The earliest and most famous was Magna Carta, which the king approved against his will in 1215. The document placed the king himself under the law. In 1628, Parliament drew up a Petition of Right. The petition claimed that certain actions of the king, such as levying taxes without the consent of Parliament, were unconstitutional.

Natural Rights. Natural law had always stressed the duties more than the rights of government and individuals. But during the late 1600's, the natural law tradition began to emphasize natural rights. The change was brought about largely by the writings of the English philosopher John Locke.

Locke argued that governmental authority depends on the people's consent. According to Locke, men originally lived in a state of nature with no restrictions on their freedom. Then they came to realize that confusion would result if each person enforced his own rights. Men agreed to live under a common government, but not to surrender their "rights of nature" to the government. Instead, they expected the government to protect these rights, especially the rights of life, liberty, and property. Locke's ideas of limited government and natural rights became part of the English Bill of Rights (1689), the French Declaration of the Rights of Man (1789), and the United States Bill of Rights (1791).

Today, many scholars reject the natural law and natural rights theories. They believe that all laws—including those guaranteeing civil rights—are simply devices that men find convenient or useful at a particular time. Nevertheless, much of the Western tradition of freedom—and nearly all civil rights laws—have resulted from the theories of natural law and natural rights.

Civil Rights Today. Civil rights have long been protected in the constitutional democracies of Western Europe. These nations include France, Great Britain, Switzerland, and the Scandinavian countries. Personal liberties are also secure in such newer democracies as Australia, New Zealand, Canada, and the United States. Many new nations of Africa and Asia have adopted constitutions that guarantee basic civil rights. But in many of these countries, unstable governments and inexperience with self-rule have often led to political arrests, censorship, and other denials of civil rights.

Most nondemocratic governments claim to protect civil rights. But in practice, they grant civil rights only when they find it politically convenient to do so. The civil rights tradition is weak in Spain, Portugal, and many Latin-American countries. Most Communist nations have constitutions that guarantee the people basic rights and liberties. However, the governments seldom enforce these rights. The Soviet Constitution, for example, guarantees the people the right to vote and assures them freedom of speech, of the press, and of assembly. But the Communist Party is the only party allowed, and the people may be punished if they publicly criticize it. The government controls newspapers, magazines, and other forms of communication.

The United Nations General Assembly adopted a Universal Declaration of Human Rights in 1948. It states that all persons are born free and are equal in dignity and rights. The declaration has been described as an international Magna Carta. Many experts in international law believe it lacks legal authority, but most agree it has high moral authority.

WILLIAM C. HAVARD

Related Articles in WORLD BOOK include:

Attainder
Bill of Rights
Censorship
Citizenship
Civil Rights, Commission on
Constitution
Constitution of the U.S.
Declaration of Independence
Democracy
Due Process of Law
Equal Employment Opportunity Commission
Fifth Amendment
Freedom
Freedom of Religion
Freedom of Speech
Freedom of the Press
Habeas Corpus
Human Rights, Universal Declaration of
Jury and Trial by Jury
Magna Carta
Minority Group
Negro (The Civil Rights Movement)
Northern Ireland (History)
Open Housing
Petition of Right
Privacy, Right of
Rights of Man, Declaration of the
Search Warrant
Segregation
Wiretapping

See also *Civil Rights* in the RESEARCH GUIDE/INDEX, Volume 22, for a *Reading and Study Guide.*

CIVIL RIGHTS, COMMISSION ON, is an independent agency of the United States government. It works to end discrimination against women and such minority groups as Indians, Negroes, and Spanish-speaking Americans. The commission investigates charges of denial of civil rights, such as equal voting rights and opportunities in education, employment, and housing.

The agency examines the effects that federal laws and policies have on civil rights. It investigates cases in which people complain of being denied equal protection of the law because of their color, national origin, race, religion, or sex. The commission also conducts studies and public hearings on various civil rights problems. It presents its findings and recommendations to the President and Congress.

The Commission on Civil Rights was established in 1957. It has six members appointed by the President, subject to the approval of the Senate. No more than three members may belong to the same political party.

Critically reviewed by the COMMISSION ON CIVIL RIGHTS

CIVIL SERVICE includes all civilian government employees who are appointed rather than elected. It

usually covers only those workers who were hired under the *merit system*. This system provides a means of selecting the best qualified person for each job. It guarantees that he will keep his job on the basis of good performance, and not on allegiance to a political party.

Civil Service in the United States

Federal Employment. The United States government hires and assigns workers in all parts of the country, in the territories and possessions, and in many other lands. Less than 10 of every 100 such employees work in the nation's capital, Washington, D.C.

The federal government is the largest single employer in the country. It has more than 2,850,000 employees working for about 110 different agencies. Nearly half of them work for the Department of Defense, and about a fourth work for the U.S. Postal Service.

Skilled government artists and engravers design and print maps, books, and currency. Plant and animal experts help improve the quality and nutritional value of foods. Engineers, administrators, and technicians conduct research on road materials, missiles, ceramics, and aeronautical safety devices. Air traffic controllers guide aircraft at airports. Government agents block counterfeiters and smugglers. Chemists ensure the purity of foods and drugs. Practically any occupation may be found in government, and several are unique to it.

Services. Positions not subject to civil service laws are considered in the *excepted service*. A few agencies are entirely excepted. For example, the Foreign Service of the Department of State has its own merit-system career program. All agencies have some excepted positions, including the politically appointed heads of departments and agencies, policy-determining officials, persons hired as temporary or occasional consultants, laborers hired in out-of-the-way places, and seasonal workers. Positions not included in the excepted service are in the *competitive service*. Merit systems cover more than 90 per cent of all federal workers.

Examinations. Applicants for federal jobs in the competitive service must take civil service examinations. Information about examinations can be obtained from many post offices and from federal job information centers in major metropolitan areas. Newspapers and radio and television stations often publicize such information. Government recruiting representatives frequently visit colleges and universities.

Different kinds of examinations apply to various types of jobs. Some examinations are written. Some are oral. Some include performance tests. For many occupations, the examiner simply evaluates applications on education, training, and experience in that occupation.

Appointments. The names of persons who pass, by scoring 70 or better, are placed on a list of eligibles in the order of their grades, plus any points given for veteran preference. The government grants extra points to veterans, disabled veterans or their wives, widows of veterans, and dependent mothers of deceased or disabled veterans. When a vacancy occurs, the hiring officer of an agency has the choice of appointing one of the three available persons with the highest grades on the appropriate eligible list.

The government conducts background investigations of the applicant. It inquires into his past record, achievements, reputation, and conduct to determine the person's honesty, integrity, loyalty, and dependability. For example, it checks schools and former employers of the applicant.

Civil Service Jobs. Federal employees belong to a modern, progressive career system. They have promotion and transfer privileges without loss of any civil service rights. The government offers career development and training programs, including opportunities for special job-related courses outside the service. Workers receive generous vacations, and sick-leave allowance that can be accumulated without limit until needed. They have a liberal retirement plan and may buy low-cost life insurance. Retirement may come as early as age 55 with 30 years of service, or as late as age 70.

Federal employment has one important restriction in the matter of political activity. The worker may vote as he chooses, and he is encouraged to exercise his political rights. But he may not be active in party politics. The penalty involves the suspension or dismissal of the worker (see HATCH POLITICAL ACTIVITIES ACT).

Compensation. The government pays federal workers according to their duties and responsibilities under several different pay plans. Mechanics and laborers have their pay set on the basis of rates prevailing in the area where they work. The government reviews the pay rates of federal office workers each year. If necessary, it adjusts the rates to make them comparable to private enterprise salaries. Most civil service pay scales have a number of grades with a series of pay steps or a range for each grade. While remaining in the same grade, a satisfactory employee's pay progresses up the range at intervals until he reaches the maximum rate. He may also be promoted to a job in a higher grade at increased pay if vacancies occur, and if he is among the best who demonstrate their readiness for additional responsibility. Federal employees receive extra pay for overtime work, and allowances if they must travel or buy uniforms for their job.

Evaluation of the work of the civil service employee is usually made at least once a year. If his performance is not satisfactory, he is dismissed or is assigned to a job that he can learn to do satisfactorily. Superior performance may be rewarded by cash awards or other recognition. Suggestions that benefit the government also receive rewards. But employees whose work or conduct is not satisfactory may be dismissed. The government must take certain procedural steps before such action can be taken against career employees. It also provides the right of appeal for workers.

Management of the federal civil service rests with the United States Civil Service Commission (see CIVIL SERVICE COMMISSION, UNITED STATES).

From time to time, Congress passes laws that change or modify the civil service system. The President issues rules for carrying out civil service laws. The commission publishes rules and regulations within this framework that agencies must follow in hiring their employees and operating their personnel programs.

State and Local Civil Service. More than two-thirds of the states and many cities and counties have civil service systems similar to that of the federal government. Even in states without a merit system, a 1940 law requires that employees who administer certain

federal funds be placed under a merit system. These funds include federal grants under the Social Security Act and grants for public health, child welfare, public employment, and vocational rehabilitation. The Intergovernmental Personnel Act of 1971 authorizes federal financial and technical aid to state and local governments to improve their personnel resources.

History. The earliest Presidents generally gave first consideration to an individual's qualifications for a job, although they tended to favor their own political supporters. By 1820, it had become fairly common to use government jobs as political rewards. An incoming President would dismiss a large number of government workers and replace them with members of his own party, regardless of their qualifications.

This turnover was based on the idea that "to the victor belong the spoils." The system became known as the *spoils system* (see SPOILS SYSTEM). By 1841, when William Henry Harrison became President, the spoils system had reached great proportions. Into Washington, D.C., swarmed 30,000 to 40,000 office seekers to claim the 23,700 jobs that then composed the federal service.

Many persons hired through the spoils system had no training for their work and no interest in it. Many were dishonest. In the early days, government work was quite simple. But as the government grew, a serious need for qualified workers developed. The government passed laws in 1853 and 1855 requiring clerk examinations to make sure that new employees would be qualified to do the work. In 1871, Congress gave the President the authority to establish tests for people seeking government jobs. But this merit-system trial ended in 1875, because Congress failed to provide funds to carry it out. The experiment proved the merit system to be both workable and helpful.

Many thoughtful leaders were pressing for a more thorough merit system in the federal, state, and local governments. In 1881, a disappointed office seeker shot and killed President James A. Garfield. Garfield's death brought public demands for civil service reforms and led to the passage of a bill introduced by Senator George H. Pendleton of Ohio. The bill became the Civil Service Act of 1883. About the same time, New York and Massachusetts began merit programs.

The new federal law called for examinations open to all citizens. It provided for selection of new workers from among those making the highest grades in these examinations. It made unlawful the firing or demoting of workers for political reasons. It relieved government workers from any obligation to give political service or payments. It established the United States Civil Service Commission to enforce the law.

At first the Civil Service Act covered only about 1 of every 10 federal positions. Later laws and executive orders have placed more jobs under civil service. They have sought to make civil service a true career service, with opportunity for advancement on merit, and with benefits in line with those offered by progressive private employers. For example, the Retirement Act of 1920 set up a pension system for civil service workers. The Classification Act of 1923 provided that all government jobs in the Washington departments be analyzed and classified so that workers would be paid according to the requirements of their jobs. A law passed in 1940 extended the provisions of that act to many positions outside Washington.

Civil Service in Other Lands

Civil service systems have been established in many other countries. Germany has one of the oldest. It dates from the Prussian system of the late 1700's. The merit system occupies a strong position in the French government. Each local government unit must have its own merit system, or accept the system developed for local administration by the national government. The British Civil Service Commission, established in 1855, became part of the Civil Service Department in 1968. The department administers the government's merit system. British government workers are in four main classes: administrative, executive, specialist, and clerical and typing.

Canada set up its first examining system for government employees in the Civil Service Act of 1908. This law covered most government positions in Ottawa. The act of 1918 established the competitive examination system and extended the number of positions covered to include most jobs in government service. The Canadian civil service has about 200,000 competitive positions, not including those positions in crown corporations. The Canadian Public Service Commission consists of three members. It classifies all positions so that the same pay is provided for the same level of work throughout the government service. It also determines what positions should be set up in government departments. It examines applicants, and provides an advisory service to departments on operations and methods, and counseling of employees. It administers a system of efficiency ratings and training activities for government executives and other personnel. Its retirement system provides an allowance for government workers who reach age 65 or who serve 35 years. Canada grants preference to veterans who have had overseas service.

O. GLENN STAHL

CIVIL SERVICE COMMISSION, UNITED STATES, is an independent federal agency created in 1883 by the Pendleton Act. The main purposes of the act are to have persons selected for nonmilitary governmental jobs on the basis of merit and to give them job security. The commission has three members, appointed by the President with the approval of the Senate. No more than two members may belong to the same political party.

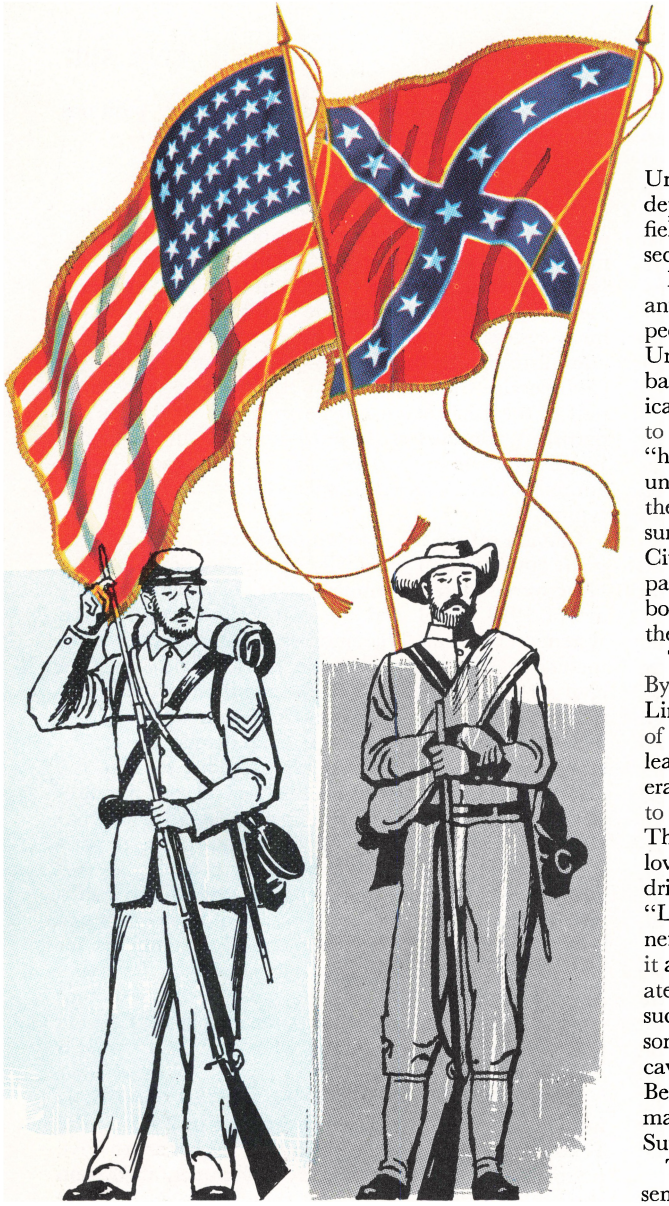
The commission provides examinations for people wanting positions in the competitive service of the federal government. It groups positions on the basis of duties and helps government agencies find the best qualified persons to fill vacancies. Regional offices in major cities throughout the United States carry out much of the commission's work.

The commission issues announcements of current federal examinations and the positions available. A copy of these announcements can be obtained from the commission's main office in Washington, D.C. The announcements can also be seen at any first- or second-class post office, at regional offices of the commission, or at federal job information centers.

Critically reviewed by the CIVIL SERVICE COMMISSION

CIVIL SUIT. See SUIT; LAW (Kinds).

CIVIL WAR



CIVIL WAR took more American lives than any other war in history. It divided the people of the United States, so that in many families brother fought against brother. The four years of bloodshed left a heritage of grief and bitterness that remains in part even today. The Civil War started on Apr. 12, 1861, when Southern artillery shelled Fort Sumter in the harbor of Charleston, S.C. It ended four years later. On Apr. 9, 1865, Confederate General Robert E. Lee surrendered his ragged, exhausted army to General Ulysses S. Grant at Appomattox Court House in Virginia. The other Confederate armies surrendered shortly afterward.

Many persons call this tragic conflict the War Between the States, the War of the Rebellion, the War of the Secession, or the War for Southern Independence. But whatever it is called, the war was a great turning point in American history. It destroyed slavery in the United States. It ended the Southern way of life that depended on slave labor in the cotton and tobacco fields. It settled the question of whether a state could secede. And it finally cemented the Union of the states.

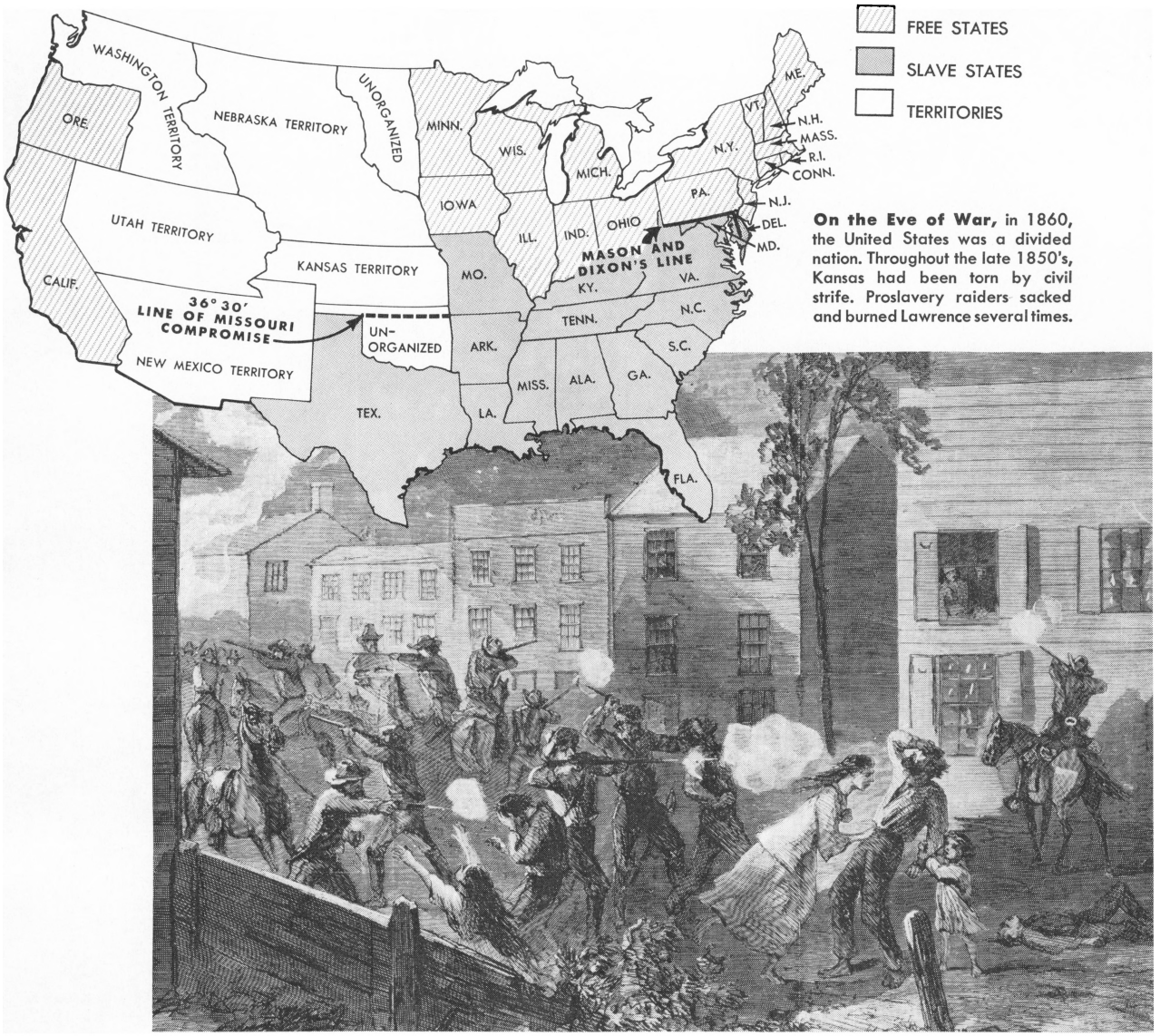
More persons are interested in the Civil War than in any other period in United States history. It fascinates people for many reasons. It took place within the United States, and Americans can easily visit the main battlefields. The Civil War was bigger than any American war before it, but it was not too big for the student to follow. But perhaps the most appealing thing is the "human side" of the war—the men who wore the gray uniforms of the Confederacy and the blue uniforms of the Union. They fought and died for what they were sure was right. Historians have written more about the Civil War than about any other period in the American past. The American people have probably read more books about these four years than about all the rest of their history put together.

The Civil War produced many colorful personalities. By far the most outstanding figures were Abraham Lincoln and Robert E. Lee. Lincoln, the 16th President of the United States, supplied the firm but patient leadership that preserved the Union. Lee, a great general, stood off superior numbers for four years and came to stand for the gallantry and devotion of the lost cause. These two men will always rank among the most beloved national heroes. The Union Army had hard-driving, cigar-chewing Ulysses S. Grant; Philip H. "Little Phil" Sheridan, the fighting cavalryman; and nervous, excitable William T. Sherman, who summed it all up when he said that "war is hell." The Confederate Army had such leaders as the Bible-quoting, lemon-sucking infantry genius, Thomas J. "Stonewall" Jackson; Nathan Bedford Forrest, perhaps the greatest cavalryman of the war; and Pierre Gustave Toutant Beauregard, the romantic Creole general who commanded the Confederate forces that attacked Fort Sumter.

The Civil War was the first modern war because, in a sense, it was the first *total war*. The North used its superior strength to destroy the economic and industrial basis of the Confederacy. In some ways, especially at the beginning, strategy and weapons followed old patterns. But the Civil War introduced methods of warfare seldom used before, such as mines and rifled weapons. It also brought such new techniques as telegraphy, photography, balloon observation, breech-loading and repeating rifles, and trenches and wire entanglements. Railroads played an important part for the first time in a large-scale war. New types of ships proved the value of armored vessels. Volunteer forces no longer furnished

One of the Greatest Battles in History took place at Gettysburg, Pa., in July, 1863. This section of a cyclorama shows the "high-water mark" of General George E. Pickett's charge. Confederates broke through Union lines at "bloody angle" on the crest of Cemetery Ridge. Strong Union resistance forced the Confederates to retreat after three days of fighting.

Photograph for *Time* by George Strock from the painting by Henry Phillippoteaux at Gettysburg National Military Park, Gettysburg, Pa.



On the Eve of War, in 1860, the United States was a divided nation. Throughout the late 1850's, Kansas had been torn by civil strife. Proslavery raiders sacked and burned Lawrence several times.

Engraving by an unknown artist (Culver)

enough manpower. The Union and Confederate governments both had to draft men into the armies. The Civil War also showed the importance of warfare that aims at the heart of a country, rather than at its army.

It was a war of total objectives. The North had to force the South back into the Union. The South wanted to force the North to recognize its independence. Neither side could accept a compromise.

Causes of the War

Historians have never reached any general agreement about the causes of the Civil War. Some believe that the slavery issue was the basic cause. Others think that the war resulted from economic rivalry between the industrial North and the agricultural South. Most agree that many factors, not just one, contributed to the situation that finally developed into the Civil War. Certainly slavery was basic to the issue.

"A House Divided"

In 1860 the United States was composed of 18 free states and 15 slave states. Abraham Lincoln called the nation "A house divided . . . half slave and half free." Actually, the United States had three great sections: the Northeast, the South, and the West. The Northeast included the New England states and New York, Pennsylvania, and New Jersey. Beyond lay the growing West (now called the Middle West). The South stretched from Maryland to Texas.

Each section had a different type of economy. Industry and finance dominated the Northeast. The South relied on farming, and produced such crops as cotton, tobacco, and sugar, mainly for export to Europe. The West also had an agricultural economy. But it grew a

greater variety of crops than the South did, and sold most of its products to the Northeast.

The class that controlled the main economic activity in each section tended to direct its politics, too. The businessmen of the Northeast and the planters of the South, both powerful minorities, provided leadership for the other classes. In the West, the farmers made up the majority group and dominated politics.

The Northeast and the West had many common interests. They had a natural trade relationship, because the West supplied the Northeast with food, and the Northeast furnished the West with manufactured goods. They also had what could be called a common set of ideals. Broadly speaking, both believed in an expanding economy and in the progressive, democratic ideas of the 1800's. These beliefs set them apart from the more conservative, aristocratic South. The agricultural West came to feel that it had more in common with the industrial Northeast than with the agricultural South.

The South had few cities or towns. Most of its people owned small farms. Some operated large plantations (see PLANTATION). But the feature of the Southern way of life that made it different from the rest of the nation was Negro slavery (see NEGRO). Fewer than 10 of every 100 Southern white men owned slaves. In 1850, when the white population of the slave states stood at 6,000,000, only 347,000 families owned slaves. About half of these families owned fewer than five slaves, although some men owned as many as 500. But even Southerners who did not own slaves favored the system. Southerners defended slavery as a positive good, rather than as a necessary evil. They felt it should be the permanent basis of their society.

"An Irrepressible Conflict"

During the 1850's, there was almost continuous quarreling between sections of the country. Senator William H. Seward of New York, who later became Lincoln's Secretary of State, called the controversy "an irrepressible conflict between opposing and enduring forces."

Each section demanded special national legislation. The Northeast wanted a protective tariff for its industries (see TARIFF [Kinds]). The West sought free farms for settlers, and federal aid for roads and other improvements. Southerners resisted measures that they felt would strengthen the national government, and opposed many demands of the other sections. The South wanted mainly to be let alone.

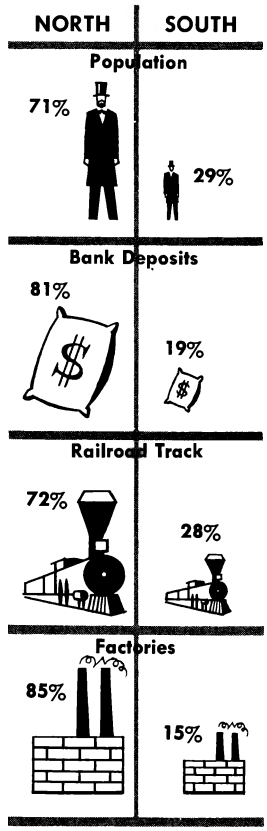
All the various sectional demands were mixed up with the slavery issue. Antislavery forces demanded that Congress should keep slavery out of the expanding country's new territories. The Wilmot Proviso, first introduced in Congress in 1846, represented continuous attempts to limit slavery (see WILMOT PROVISO). Southerners replied that slavery could not legally be barred from land that belonged to the whole nation.

Some leaders tried to settle the issue by compromise. Two important measures were the Missouri Compromise and the Compromise of 1850 (see MISSOURI COMPROMISE; COMPROMISE OF 1850). But the organization of new territories usually brought the problem up again.

In 1854, Senator Stephen A. Douglas of Illinois pushed through Congress the Kansas-Nebraska Act, which established two new territories. This measure proposed to settle the slavery question by "popular sovereignty"—that is, by letting the territorial legislatures decide whether the areas should have slavery. The Kansas-Nebraska Act made slavery legally possible in two territories from which it had been barred. See KANSAS-NEBRASKA ACT.

Public opinion in the North ran strongly against the bill. The Whig party broke up over the slavery question. In its place appeared the new Republican party, dedicated to preventing slavery from expanding to the territories. Abraham Lincoln soon joined the new party. In 1858, he and Douglas aroused national interest in a series of famous debates on the slavery question.

In Kansas, meanwhile, opponents and supporters of slavery poured into the new territory and clashed in armed conflict. Much of the violence resulted from the rough frontier spirit. But many Northerners believed that the South wanted to force slavery on "bleeding Kansas."



Resources in 1860 favored the North. But the South had the advantage of fighting on its own soil and, in the beginning, better commanders.

The Supreme Court entered the situation in 1857 with the Dred Scott decision, a case involving a slave who claimed freedom because he had been taken into territory where slavery was illegal. The court ruled that Congress could not exclude slavery from the territories (see DRED SCOTT DECISION). Southerners rejoiced, but became angry when Republican leaders refused to accept the decision as legally binding.

Several Northern states passed "personal-liberty laws." These acts encouraged people to disobey federal laws providing for the return of fugitive slaves. *Abolitionists*, or persons who wanted to destroy slavery, had begun to attack the Southern system in the early 1800's. They formed only a small minority, but Southerners felt they were a real danger to the South. Abolitionists organized the "underground railroad," which helped runaway slaves escape (see UNDERGROUND RAILROAD). The most effective attack on slavery was the book *Uncle Tom's Cabin*, which appeared in 1852. This novel by Harriet Beecher Stowe sold 300,000 copies within a year. In 1859, a fanatical abolitionist named John Brown led a raid on Harpers Ferry, Va. He planned to seize the federal arsenal and start a slave uprising. Government troops under Col. Robert E. Lee captured Brown, and he was later hanged. But Southerners thought that Northern leaders had encouraged Brown's scheme.

In the presidential election of 1860, the Democratic

Drawing by Thure de Thulstrup; Library of Congress, Washington, D.C.

Basic Strategy of the war involved encirclement and blockade by the North, sometimes called the "anaconda policy," and a series of short counterattacks by the South.

Sheridan's Ride turned defeat into victory at the Battle of Cedar Creek, Oct. 19, 1864. He "dashed down the line, 'mid a storm of huzzas" and rallied retreating soldiers.

HIGHLIGHTS OF THE CIVIL WAR

1861

Apr. 12 Confederate troops attacked Fort Sumter.
Apr. 15 Lincoln issued a call for troops.
Apr. 19 Lincoln proclaimed a blockade of the South.
May 21 Richmond, Va. was chosen as the Confederate capital.
July 21 Northern troops retreated in disorder after the first Battle of Bull Run (Manassas).

1862

Feb. 6 Grant's Northern troops captured Ft. Henry.
Feb. 16 Fort Donelson fell to Union forces.
Mar. 9 The ironclad ships *Monitor* and *Merrimack* battled to a draw.
Apr. 6-7 Both sides suffered heavy losses in the Battle of Shiloh, won by the Union.
Apr. 16 The Confederacy began to draft soldiers.
Apr. 18-29 A Union fleet under Farragut captured New Orleans.
May 4 McClellan's Union troops occupied Yorktown, Va., and advanced on Richmond.
May 30 Northern forces occupied Corinth, Miss.
June 6 Memphis fell to Union armies.
June 25-July 1 Confederate forces under Lee saved Richmond in the Battles of the Seven Days.
Aug. 29-30 Lee and Jackson led Southern troops to victory in the second Battle of Bull Run.
Sept. 17 Confederate forces retreated in defeat after the bloody Battle of Antietam (Sharpsburg).
Sept. 22 Lincoln issued a preliminary Emancipation Proclamation.
Oct. 8 Buell's forces ended Bragg's invasion of Kentucky in the Battle of Perryville.
Dec. 13 Burnside's Union forces received a crushing blow in the Battle of Fredericksburg.
Dec. 31-Jan. 2, 1863 Union troops under Rosecrans forced the Confederates to retreat after the Battle of Murfreesboro (Stones River).

1863

Jan. 1 Lincoln issued the Emancipation Proclamation.
Mar. 3 The North passed a draft law.
May 1-4 Northern troops under Hooker were defeated in the Battle of Chancellorsville.
May 1-19 Grant's army defeated Confederates in Mississippi and began to besiege Vicksburg.
July 1-3 The Battle of Gettysburg ended in a Southern defeat and marked a turning point in the war.
July 4 Vicksburg fell to Northern troops.
July 8 Northern forces occupied Port Hudson, La.
Sept. 19-20 Southern troops under Bragg won the Battle of Chickamauga.
Nov. 19 Lincoln delivered the Gettysburg Address.
Nov. 23-25 Grant and Thomas led Union armies to victory in the Battle of Chattanooga.

1864

Mar. 9 Grant became general in chief of the North.
Apr. 8-9 Federal troops under Banks met defeat in the Red River expedition.
May 5-6 Union and Confederate troops clashed in the Battle of the Wilderness.
May 8-12 Grant and Lee held their positions in the Battle of Spotsylvania Court House.
June 3 The Union suffered heavy losses in the Battle of Cold Harbor.
June 20 Grant's troops laid siege to Petersburg, Va.
July 11-12 Early's Confederate forces almost reached Washington, but retreated after brief fighting.
Aug. 5 Farragut won the Battle of Mobile Bay.
Sept. 2 Northern troops under Sherman entered Atlanta.
Nov. 8 Lincoln was re-elected President.
Nov. 15 Sherman began his march to the sea.
Nov. 16 Hood invaded Tennessee.
Nov. 30 Schofield's Union forces inflicted heavy losses on Hood in the Battle of Franklin.
Dec. 15-16 The Battle of Nashville smashed Hood's army.
Dec. 21 Sherman's troops occupied Savannah, Ga.

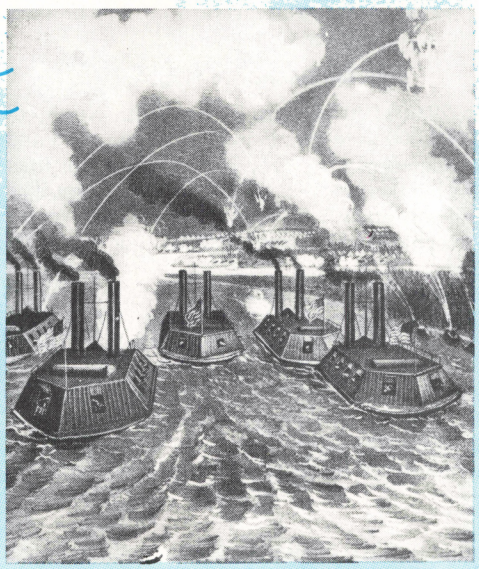
1865

Feb. 3 The Hampton Roads Peace Conference failed to end the war.
Feb. 6 Lee became general in chief of the South.
Apr. 2 Confederate troops gave up Petersburg and Richmond.
Apr. 9 Lee surrendered to Grant at Appomattox.
Apr. 14 Lincoln was assassinated.
Apr. 26 Johnston surrendered to Sherman.
May 4 Confederate forces in Alabama and Mississippi surrendered.
May 26 The last Confederate troops surrendered.

PA.
New York
Gettysburg
N.J.
MD.
DEL.
OHIO
IND.
ILL.
W. VA.
Washington
Ohio R.
VA.
Richmond
Appomattox Court House
MO.
Cairo
KY.
N.C.
TENN.
Nashville
Chattanooga
Memphis
S.C.
ARK.
Mississippi R.
Atlanta
Charleston
MISS.
ALA.
GA.
Ft. Sumter
Savannah
Vicksburg
Montgomery
UNION NAVAL BLOCKADE
LA.
Mobile
Jacksonville
St. Augustine
New Orleans
FLA.

UNION MOVEMENTS

CONFEDERATE THRUSTS

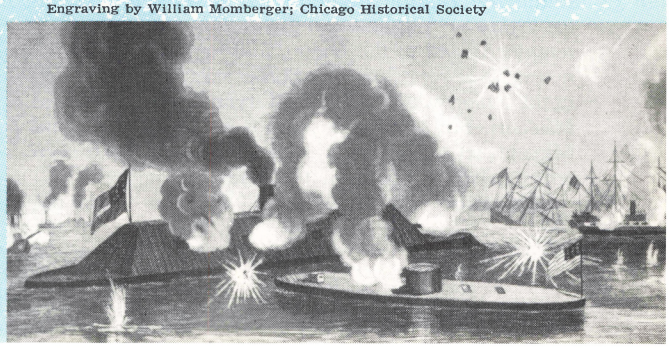


Lithograph (1862) by Currier and Ives; Library of Congress, Washington, D.C.

On the Mississippi, *left,* the Union used ironclads to attack Confederate shore batteries. Many of the vessels were old wooden ships covered with sheets of metal armor.

"The Battle of the Ironclads" pitted the *Merrimack, left,* against the *Monitor, right.* This historic conflict dramatized the possibilities of armor-plated warships.

Engraving by William Momberger; Chicago Historical Society



party split into Northern and Southern branches. Stephen A. Douglas ran on the Northern ticket, and John C. Breckinridge on the Southern one. Former Whigs formed the Constitutional Union party to urge national unity, and nominated John Bell. The Republicans nominated Abraham Lincoln of Illinois. Their platform went beyond mere opposition to the spread of slavery. They wanted to unite the major economic groups in the North with a program favoring tariffs for manufacturers, free homesteads for farmers and workers, central banking for merchants and financiers, and government-subsidized railways for everyone. Lincoln received only about 40 per cent of the popular vote. But this was more than any of his opponents received. He had a majority of electoral votes, and he became President.

Secession

Before the election, many Southern leaders had urged *secession*, or withdrawal from the Union, if Lincoln should win. Many Southerners favored secession as part of the doctrine of states' rights (see STATES' RIGHTS). Secessionists held that the national government was a league of sovereign states, and that any state had a legal right to withdraw from the Union.

South Carolina had always firmly supported states' rights. It had threatened to secede in 1832 in a crisis involving the national tariff (see NULLIFICATION). In December, 1860, South Carolina adopted the Ordinance of Secession, and became the first state to secede from the Union. By the time Lincoln was inaugurated in March, 1861, six other states had followed. They were, in order of their withdrawal, Mississippi, Florida, Alabama, Georgia, Louisiana, and Texas. In February, representatives from six of these states met in Montgomery, Ala., and established a Southern nation, the Confederate States of America. They elected Jefferson Davis as President and Alexander Stephens as Vice-President.

Secession led to the proposal of a number of compromise measures. But only the Crittenden Compromise received serious consideration, and it did not have much support from either Republicans or secessionists. See CRITTENDEN COMPROMISE.

In Lincoln's inaugural address, he avoided any threat of immediate force against the South. But he stated that secession was illegal, and that he would hold federal possessions in the South. One of these possessions, Fort Sumter, lay in the harbor of Charleston, S.C. Lincoln sent supplies to Sumter in April, 1861. The Confederates fired on the fort on April 12, and forced the garrison to surrender on April 13 (see FORT SUMTER). On April 15, Lincoln called for troops to enforce the nation's laws. The South regarded this move as the equivalent of a declaration of war. Virginia, Arkansas, North Carolina, and Tennessee promptly joined the Confederacy.

Virginia had long been undecided about which side to join. Its decision to join the Confederacy boosted Southern morale, and Richmond became the capital of the Confederacy in May. The federal government offered Robert E. Lee of Virginia the field command of the United States Army, but he refused. "How can I draw my sword upon Virginia, my native state?" Lee asked when he resigned from the federal army.

Mobilizing for War

How the States Lined Up

Eleven states fought for the Confederacy. From east to west, they were: Virginia, North Carolina, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, and Texas. The 23 Union states stretched from coast to coast. They were, from east to west: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Pennsylvania, Ohio, Michigan, Indiana, Kentucky, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Oregon, and California. The territories of Colorado, Dakota, Nebraska, Nevada, New Mexico, Utah, and Washington also fought on the Union side.

Both the Union and the Confederacy included *border states*, or slave states that lay between the North and the Deep South. Some people in these states supported the North, but others believed in the Southern cause. Ironically, the heaviest fighting of the war took place in the border states. Border states on the Southern side were Virginia, North Carolina, Tennessee, and Arkansas. However, Virginians in the western part of the state remained loyal to the Union, and in 1863 formed the new state of West Virginia. Border states that remained in the Union were Delaware, Maryland, Kentucky, and Missouri. But secessionist groups from Kentucky and Missouri set up their own state governments, and even sent representatives to the Confederate Congress.

The terms "the North" and "the South" do not mean that all the people in these sections agreed among themselves. Many families were torn by divided loyalties, and close relatives often fought each other. Men from every state fought in both armies. George H. Thomas, one of the best Union generals, was born in Virginia. General John C. Pemberton, the Confederate commander at Vicksburg, came from Pennsylvania. One of the most successful Union financial agents in Europe, Robert J. Walker, had once represented Mississippi in the United States Senate. Caleb Huse, a Confederate purchasing agent in Europe, came from Massachusetts. Three of Mrs. Mary Todd Lincoln's brothers died in the service of the Confederacy.

Rallying Round the Flags

About 22,000,000 persons lived in the North, of whom 4,000,000 were men between the ages of 15 and 40. The Confederacy had a population of more than 9,000,000, but this included about 3,500,000 slaves. The South had only about 1,140,000 white men between 15 and 40 to fight under the Stars and Bars, the Confederate flag.

At the beginning of the war, neither government had a plan of mobilization. The Regular Army of the United States at that time consisted of only about 16,000 men, most of whom fought for the North. Both sides tried to raise their armies by appealing to volunteers. This system worked at first. The states, rather than the Union or Confederate governments, recruited most volunteers, and often supplied them. Any man who wanted to

organize a company or a regiment could do so. Some units of both sides marched into battle wearing the colorful uniforms of French zouaves. In the North, especially late in the war, volunteers often received a *bounty*, or payment for enlisting. The bounty system encouraged thousands of *bounty jumpers*, who deserted after being paid. Many of these men enlisted several times, often using a different name each time.

The Draft. As the war went on, volunteer enlistments decreased. Both sides then tried drafting soldiers. Southern draft laws, first passed in April, 1862, made all able-bodied men between 18 and 35 (later 17 to 50) liable for three years' service. The Northern program, begun in March, 1863, drafted men between 20 and 45 for three years. Both sides allowed a draftee to pay a substitute to serve for him. In the North, a draftee could pay the government $300 to avoid military service. Many soldiers grumbled that this made it "a rich man's war and a poor man's fight."

The draft proved extremely unpopular in many areas of the North. In New York City in July, 1863, armed mobs set fire to buildings and took over parts of the city before police and the Army restored order.

No one knows exactly how many men served in the Civil War. The totals on both sides included many short-term enlistments and "repeaters." According to the best estimates, 1,500,000 men served three-year terms in the Union Army, and 900,000 men served in the Confederate Army for the same period. The Southern army reached peak strength in 1863, then declined. But the Northern armies grew. In the last year of the war, the North had more than 1,000,000 men in arms. The South probably had no more than 200,000.

Military Leadership. Abraham Lincoln and Jefferson Davis had to choose their commanders on the basis of what they knew about them or what their advisers told them. Sometimes they selected a man because of his reputation, and sometimes for political, rather than military, reasons.

Davis fortunately had Robert E. Lee to take command of the eastern Confederate army, the Army of Northern Virginia. Lee's able officers included Stonewall Jackson and James Longstreet. The Confederate commanders in the West—Albert Sidney Johnston, Pierre G. T. Beauregard, Braxton Bragg, and Joseph E. Johnston—had less ability.

Lincoln tried several commanders for the eastern Union army, the Army of the Potomac: George B. McClellan, Ambrose E. Burnside, Joseph Hooker, and George G. Meade. All had serious weaknesses. Lincoln's western generals—Henry W. Halleck, Don Carlos Buell, and William S. Rosecrans—also failed to meet his expectations. None of his commanders seemed aggressive enough. But, as the war progressed, four great generals emerged from the battlefields to lead the Union armies to victory: Ulysses S. Grant, William T. Sherman, Philip H. Sheridan, and George H. Thomas.

Johnny Reb and Billy Yank

Civil War "G.I.'s" were much like American enlisted men of earlier and later wars. Northern troops called the gray-uniformed Southern soldier *Johnny Reb* (for "rebel"). The Southerners called the blue-uniformed enemy *Billy Yank*, or simply *Yank*. Johnny and Billy fought well, but they remained civilians, with the civilian's dislike of military rules and regulations. In most regiments, the men all came from the same area. Many units elected their own officers. One soldier wrote: "We . . . had no patience with the red-tape tomfoolery of the regular service . . . a private was ready at the drop of a hat to thrash his commander—a thing that occurred more than once."

"A Soldier Has a Hard Life, and but little consideration," Lee wrote to his wife. Civil War soldiers received more leaves and furloughs than soldiers of previous wars, and had better food and clothing. But, compared to modern standards, Johnny and Billy suffered many hardships. Like all soldiers, they griped about their lot. The pay was poor. Both sides paid their soldiers only $11 a month at first. The pay was later raised to $16 in the North and $18 in the South. Food supplies included flour, corn, pork, and beans. But most army cooks had never cooked before, and many soldiers preferred to prepare their own food. Armies on the march ate salt pork and hard biscuits called *hardtack*, and drank coffee. Poorly made clothing of *shoddy*, or rewoven wool, often fell apart in the first storm. Southern soldiers frequently lacked shoes and had to march and fight barefoot.

Most soldiers on both sides carried Springfield rifles. These muzzle-loading, one-shot guns seem primitive compared with today's weapons. But they had an effective range of 250 yards (229 meters), twice as long as earlier muskets. However, Civil War infantry still often marched in close-order formation, as in earlier days, and presented an easy target. A determined force in a strong position could withstand almost any frontal assault. The brass muzzle-loading, smoothbore "Napoleon" provided the basic artillery weapon. It could fire 1 mile (1.6 kilometers), but was most effective at half that distance, and at shorter ranges was murderous on attacking troops. Many Civil War battles proved extremely costly. An army often lost 25 of every 100 men in a major battle. Some regiments at Gettysburg and other battles lost 80 of every 100. Because of heavy casualties, Civil War soldiers devised the first "dog tags." A soldier often lettered his name and address on his handkerchief or a piece of paper and pinned it to his uniform before going into battle.

Hospitals and Prisons. Sanitary conditions during the Civil War were shocking by modern standards. Medical science had not yet discovered the importance of antiseptics in preventing infection, and many thousands of men died from wounds and disease. The government maintained some medical facilities. Dorothea Dix, famous for her earlier work in mental institutions, served as superintendent of women nurses. Private organizations also helped care for ill and wounded soldiers. The United States Sanitary Commission, created in June, 1861, operated hospitals and distributed supplies. It cared for Southern, as well as Northern, men. A similar organization, the Christian Commission, provided welfare assistance. The thousands of volunteer nurses included Clara Barton, who later founded the American Red Cross.

As the war went on, both North and South became burdened with large numbers of prisoners. Earlier systems of exchange broke down because of bad feeling and confusion as to the legal status of the Confederacy.

The South especially had difficulty in taking adequate care of prisoners when many of its own civilians and soldiers lacked food and clothing. At Andersonville, in southwestern Georgia, as many as 30,000 Northern prisoners at a time were crowded into a log stockade that enclosed only 16½ acres (6.7 hectares). More than 12,000 graves bear witness to the frightful conditions there. Other Confederate prisons included Libby and Belle Isle in Richmond. Overcrowding and shortages also existed in Northern prisons, such as those at Rock Island, Ill., Johnson's Island in Lake Erie near Sandusky, Ohio, and Fort Lafayette in New York harbor.

Negroes in the Civil War

From 1861 to 1863. The fighting had hardly started when Negroes in the North tried to enlist in the armies being raised. They wanted to fight to end slavery. The Army rejected them, however. Most whites felt that the Civil War was a "white man's war." Many, including Lincoln, also believed that blacks would make poor soldiers. In addition, Lincoln feared that using black soldiers or freeing slaves would mean the loss of Union support in the slave-owning border states.

Large numbers of slaves flocked to Union camps as Northern armies drove into Confederate territory. One Union commander, General Benjamin F. Butler, declared early in the war that such slaves were "contraband" and should not be returned to their owners (see CONTRABAND). But other officers returned many "contrabands" because of the difficulty in caring for them.

In 1861, the Union General John C. Frémont proclaimed freedom for all Missouri slaves whose owners took up arms against the United States. Abolitionists hoped that such a policy could be established in all the Confederate states. They felt it would end slavery and the war as well, because slaves greatly helped the Southern war effort. Slaves performed such jobs as raising food and working in factories, making whites available for military duty. However, Lincoln canceled Frémont's order and removed him from command.

An increasing number of Union defeats and a decline in white enlistments caused Congress to pass two important laws in July, 1862. The first of these laws, the Confiscation Act, declared free all slaves whose owners aided the Confederacy. It also enabled Lincoln to use Negroes for any purpose in the war effort. The second law, the Militia Act, gave Lincoln the specific power to use blacks as soldiers, though he refused to do so immediately. He did allow about 200,000 blacks to work for Union forces as cooks, laborers, nurses, scouts, and spies.

The Emancipation Proclamation. The war continued to go badly for the North. Finally, Lincoln decided "that we . . . must change our tactics, or lose the game." On Sept. 22, 1862, he announced that unless the rebelling states returned to the Union by Jan. 1, 1863, he would issue a proclamation freeing their slaves. The South ignored his warning, and so on New Year's Day, 1863, Lincoln issued the Emancipation Proclamation (see EMANCIPATION PROCLAMATION).

Significantly, the proclamation also announced Lincoln's decision to use Negro troops. By the end of the war, about 180,000 blacks had served in the Union Army. Another 30,000 blacks fought as sailors and made up about a fourth of the Union Navy. Negro troops served in all-black regiments, most of which had white commanders. Only about 100 blacks became officers. Until 1864, when Congress authorized equal bounties and pay for Negroes, black soldiers received no bounties and only about half the pay of whites. The Army jailed or shot Negro soldiers who protested for equal pay.

Blacks fought in more than 190 battles, and about 68,000 Negro soldiers and sailors were killed or wounded. Twenty-one blacks won the Congressional Medal of Honor. Lieutenant Colonel Oliver T. Beard, who commanded one of the first black companies to see combat, reported that "the colored men fought with astonishing coolness and bravery." Lincoln called the Negro troops an important "physical force" that "we cannot spare. . . . Keep it and you can save the Union. Throw it away, and the Union goes with it."

Reaction in the South. The South objected strongly to the North's use of black soldiers, and Confederate troops fought fiercely against Negroes. After a battle at Fort Pillow, Tenn., in 1864, Southern forces under General Nathan Bedford Forrest reportedly massacred many blacks who had surrendered.

In 1865, the South became desperate for soldiers. The Confederate Congress passed a law calling for slave-owners to provide 300,000 slave-soldiers. But the war ended before this program could be carried out.

Chicago Historical Society

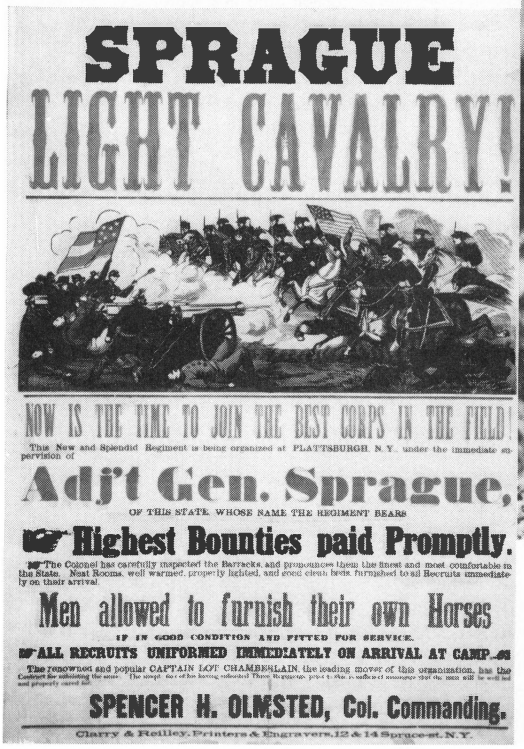
Civilian Hardships were greater during the Civil War than in any other American war. "The Mother's Sacrifice," above, typifies the sentimentality of the period, and shows a little child leaving his home to become a drummer boy.

The Home Fronts

In the North

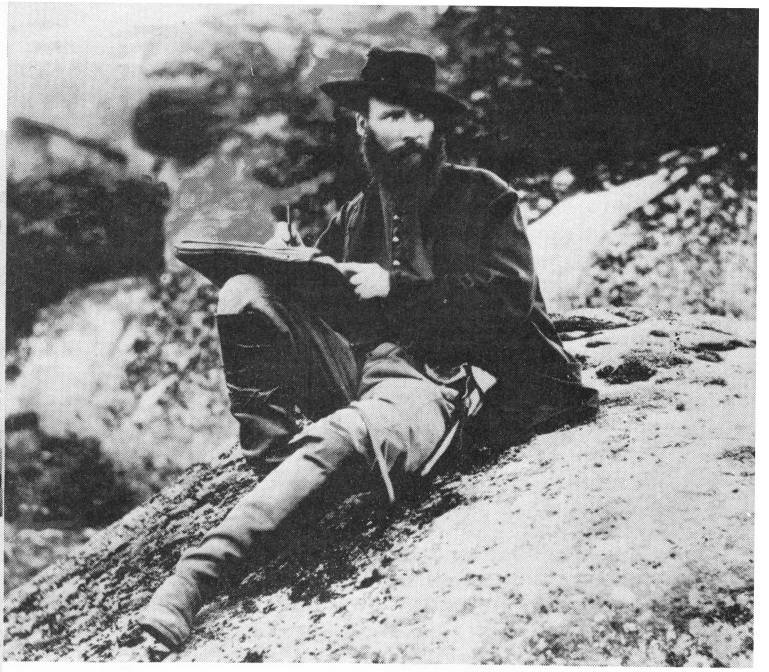
Abraham Lincoln conducted the war with unceasing vigor. But during the war, one group in his own party opposed him in Congress. This group, called the Radical Republicans, wanted to use the war to destroy slavery. Lincoln favored a gradual form of freeing the slaves, but the pressures of war helped the Radical Republicans. Northerners grew more bitter against the South and more hostile to slavery. After Lincoln issued the Emancipation Proclamation, the North fought to free slaves as well as to preserve the Union.

Lincoln was the first President to use the vast war powers of his office. He boldly summoned troops to



L. Berman Collection

Recruiting Volunteers was no easy task. Posters advertised the merits of individual companies. This one praises a New York cavalry regiment, which "allowed" men to bring their own horses.



Brady, Library of Congress

War Correspondents traveled with the armies to report events for those at home. Mathew Brady, the famous photographer, showed the artist A. R. Waud sketching for *Harper's Weekly*.

suppress the "rebellion," increased the size of the army, and proclaimed a naval blockade of the South. He was widely criticized for suspending the right of habeas corpus in many areas where people opposed the war. Most of these persons belonged to a group in the Democratic party known as "Peace Democrats." Unionists called them "Copperheads," after a poisonous snake. The Copperheads wanted an immediate armistice and a peaceful settlement of the war. Lincoln had many of them arrested as Southern sympathizers and imprisoned without trial. But freedom of the press continued, and many newspapers and individual citizens still denounced the Lincoln administration.

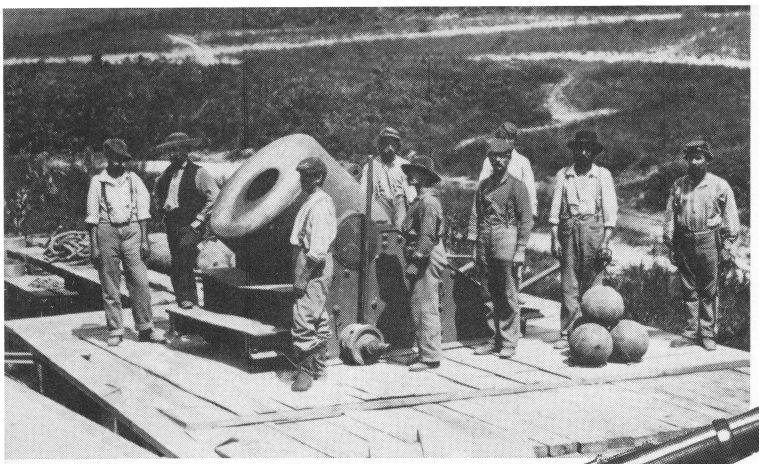
Expansion. The war plunged the North into a period of booming prosperity. Government purchases for military needs stimulated industry and farming. Expanding industries included iron and steel, woolen clothing, shoes, munitions, railroads, and coal. Farmers vastly increased wheat and wool production. Factories and farms made the first widespread use of laborsaving machines such as the sewing machine and the reaper. The war forced the economy into an early form of mass production. And the nation itself expanded as settlers moved westward.

Popular Feeling. Leading newspapers sent their best correspondents to the field. The Civil War became the first conflict to be completely and immediately reported, even though poor communications systems usually delayed publication of the news for several days. Winslow Homer drew and painted war scenes for *Harper's Weekly* magazine. Photography came into its own through the work of Mathew Brady and others. A flood of popular songs and ballads included "John Brown's Body" (the melody was later used for Julia Ward Howe's "Battle Hymn of the Republic"), "The Battle Cry of Freedom," and "Marching Through Georgia." Some Northern songs, such as "Tenting on the Old Camp Ground" and "When Johnny Comes Marching Home," also became popular in the South.

In the South

Jefferson Davis, President of the Confederacy, did not have Lincoln's vigor and certainty. Lincoln assumed that he had the power to suspend civil law, and did so. Davis asked the Confederate Congress for this power, and received only limited permission. Davis also lacked Lincoln's skill in managing men. For years, Southerners had resisted a powerful central government. Some found it difficult to cooperate with officials of their own government, states, and cities. States' rights supporters backed the war, but opposed conscription and other measures needed to carry it out.

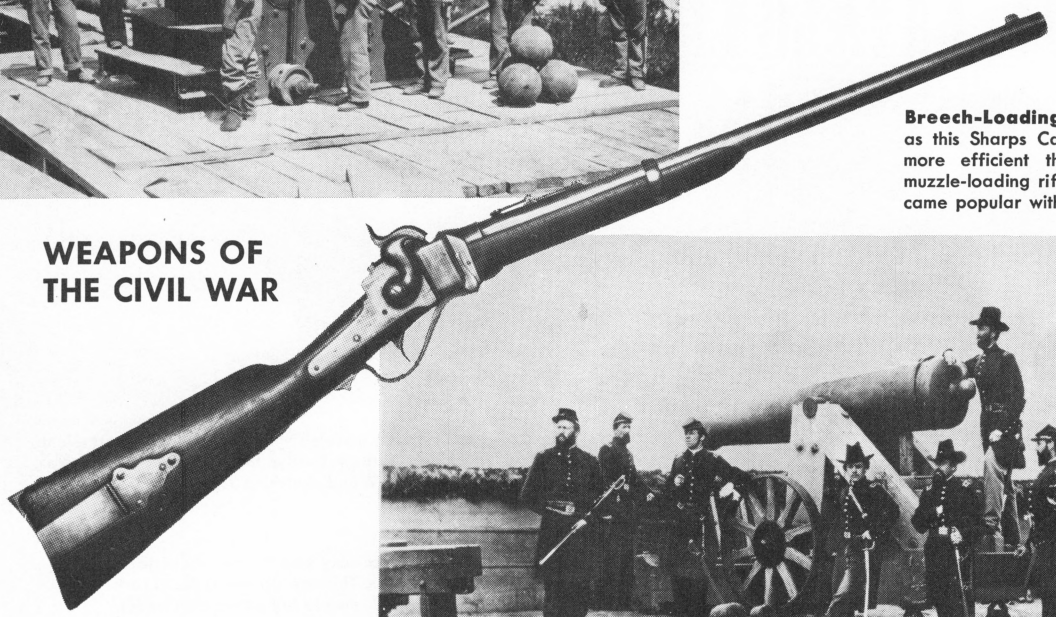
How People Lived. The demands of total war strained the economy of the South almost to the breaking point. The Confederacy lacked the industries to supply its armies and civilians. Imports dwindled as the Northern blockade tightened. Southern troops were never so well equipped as their Northern foes. Northern factories could produce about 5,000 rifles a day, but Southern factories could turn out only 300. The war gradually used up Southern resources. People made clothes out of carpets and curtains, and printed newspapers on the back of wallpaper. Wild inflation set in. Flour sometimes cost $300 a barrel, and shoes $200 a pair.

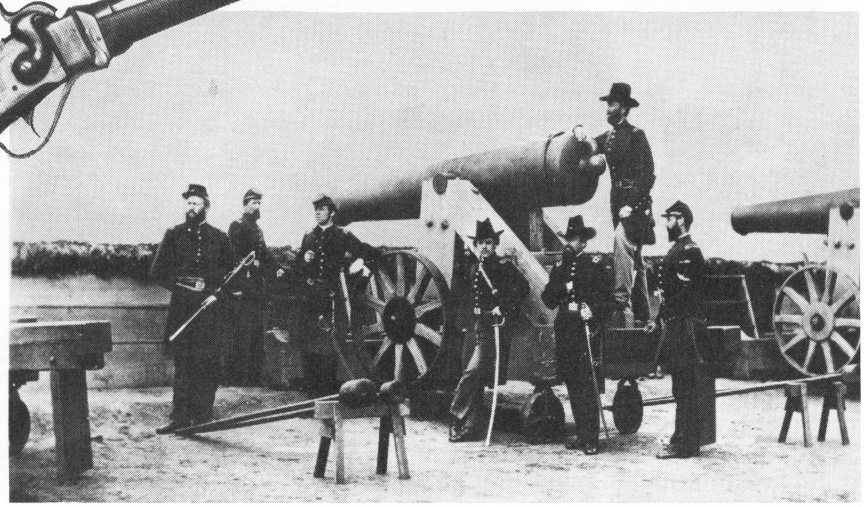


Mortars, used for sieges and coastal defense, hurled cannon balls in a high arc. The model at *left* had a 13-inch (33-centimeter) bore and a range of 2½ miles (4 kilometers).

Breech-Loading Guns, such as this Sharps Carbine, were more efficient than the old muzzle-loading rifles, and became popular with both sides.

WEAPONS OF THE CIVIL WAR





Cannon with rifled barrels, a recent artillery development, sent shells spinning forward in a long, flat arc.

Chicago Historical Society

Shortages of necessities weakened the people's will to fight, but most Southerners vigorously supported the war effort. As in the North, songs showed the spirit of the people. Men marched to war to the stirring music of "Dixie" and "The Bonnie Blue Flag." The mournful notes of "Lorena" and "All Quiet Along the Potomac Tonight" were popular in the North as well.

Cotton Diplomacy. At the beginning of the war, Confederate leaders felt sure that Europe would come to the aid of the South. Southerners believed that, because Great Britain and France depended on Southern cotton for their textile industries, a shortage of cotton would force them to intervene on the Southern side. In 1861, the Confederacy sent two diplomats, James Mason and John Slidell, to Europe to persuade Britain and France to take up the Southern cause. Mason and Slidell sailed from Havana, Cuba, on a British ship, the *Trent*. The captain of a Northern warship rashly stopped the *Trent* and seized the diplomats. Great Britain threatened war, and the North gave in. See TRENT AFFAIR.

But the South failed to obtain European recognition or any substantial help through its "cotton diplomacy." Britain and France did allow the Confederacy to have six raiders built in their shipyards. The most famous ship, the *Alabama*, caused millions of dollars worth of damage to Northern shipping before the Union ship *Kearsarge* sank it in 1864 (see ALABAMA [ship]). But Britain and France would not intervene in the war unless the South could show that it might win a final victory on the battlefield. And that never happened.

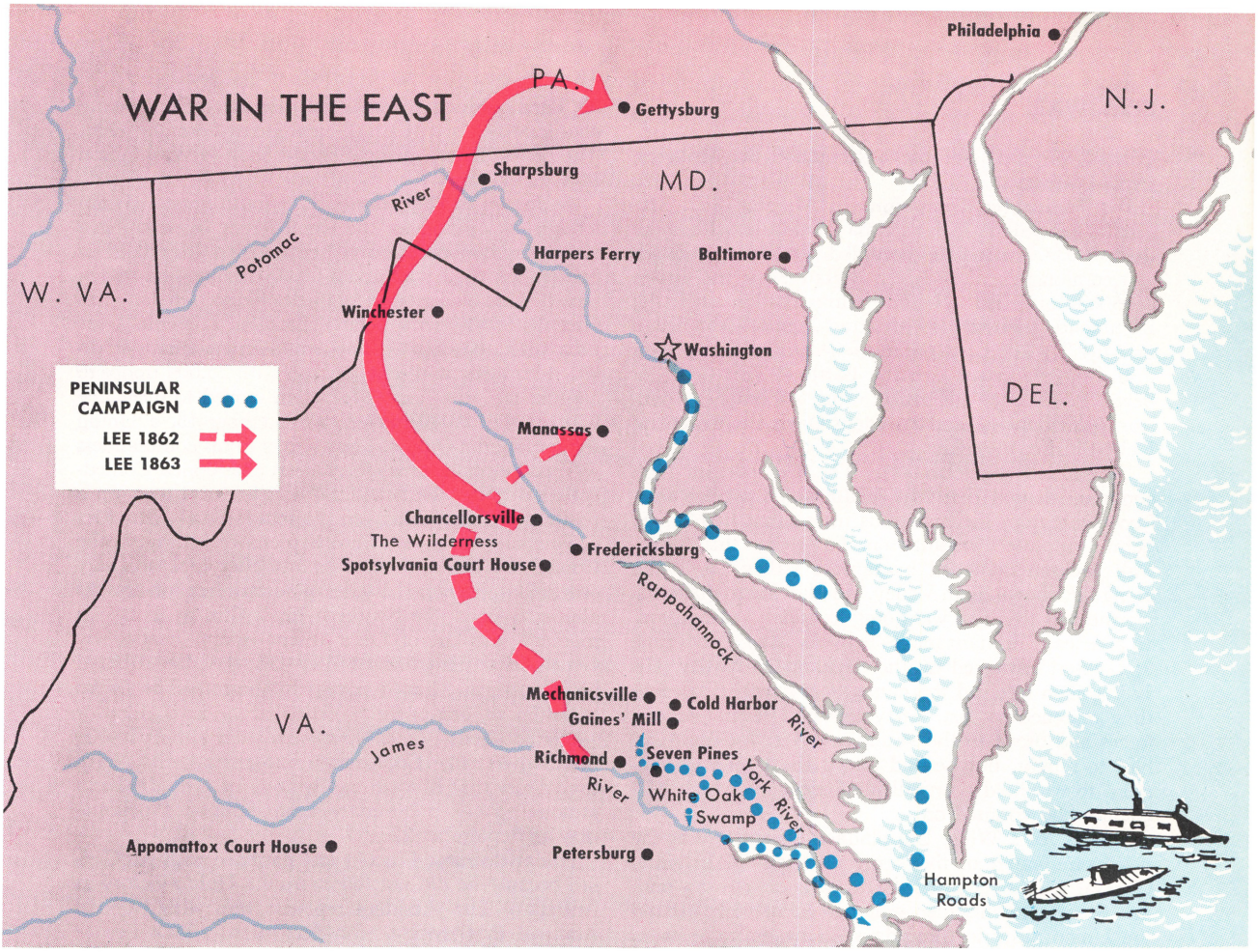
The War in the East, 1861-1864

The Appalachian Mountains divided the Civil War into two main areas of operations. The Eastern front stretched east of the mountains to the Atlantic Coast. The Western theater lay between the mountains and the Mississippi River. A third area, west of the Mississippi, had little strategic importance.

At the beginning of the war, neither North nor South had a prepared plan of strategy. The North had to defeat the South in order to restore the Union, and so its commanders had to plan military offensives. Southern commanders designed strategy to hurl back Northern thrusts, and seldom launched great offensive campaigns. The Confederacy did not have to conquer the North. It needed only to defend its own territory until the North became weary of the war.

Opening Battles

Fort Sumter. The Civil War began on Apr. 12, 1861, when Confederate forces under General Pierre G. T. Beauregard successfully attacked Fort Sumter in Charles-



ton harbor (see FORT SUMTER). The federal government collected an army of more than 30,000 men near Washington, D.C., under General Irvin McDowell. Another Union force of 14,000 under General Robert Patterson held the northern end of the Shenandoah River Valley, a secondary route between the rival capitals of Washington and Richmond. A Confederate force of more than 20,000 under Beauregard faced McDowell at Manassas, Va. General Joseph E. Johnston commanded 11,000 more Confederates in the Shenandoah Valley.

First Bull Run, or Manassas. In July, McDowell approached Manassas, on a creek called Bull Run. (Many Civil War battles have two names because the Confederates named them after the nearest settlement, and Northerners often named them after the nearest body of water.) McDowell thought his troops could destroy Beauregard's forces while the Union Army in the Shenandoah Valley kept Johnston occupied. But Johnston slipped away and joined Beauregard just before the battle. The opposing forces, both composed mainly of poorly trained volunteers, clashed on July 21. The North launched several assaults. During one attack, General Thomas J. Jackson stood his ground so firmly that he received the nickname "Stonewall." After halting several assaults, Beauregard counterattacked. The tired Union forces broke and fled to Washington in wild retreat.

The North realized for the first time that it faced a long fight. The war would not be over in three months, as many Northerners had confidently predicted. The Southern cause had gained great prestige, and Confederate optimism and confidence ran high.

On to Richmond!

After Bull Run, Lincoln made General George B. McClellan commander of the eastern army, soon to be known as the Army of the Potomac. During the winter of 1861-1862, McClellan assembled a force of 150,000 men. He proved to be a superb trainer of troops. "Little Mac" planned to capture Richmond from the southeast. He wanted to land his forces on the peninsula between the York and James rivers, and advance along one of the rivers toward the Southern capital. Lincoln feared that this scheme would leave Washington open to a Confederate raid, but he let McClellan try it. However, before McClellan could move, a naval action changed his plans.

The *Monitor* and the *Merrimack*. The Confederates had raised a sunken federal ship, the *Merrimack*, at Norfolk, Va., and covered it with iron plates. On Mar. 8, 1862, this ship (renamed the *Virginia*) attacked Northern ships at Hampton Roads and destroyed two of them. When the ship returned the next day, it found a newly arrived Northern ironclad, the *Monitor*, waiting. Neither ship won the battle that followed. But the *Virginia* (*Merrimack*) did prevent McClellan from using the

James River, the best route to Richmond. See MONITOR AND MERRIMACK.

The Peninsular Campaign. In March, 1862, McClellan landed on the Virginia Peninsula with more than 100,000 men. He occupied Yorktown and advanced along the York River. By late May, the Union army had marched to within 6 miles (10 kilometers) of Richmond. Johnston led an attack against McClellan on May 31. The Confederates failed to follow up their initial success in the two-day Battle of Fair Oaks (or Seven Pines), and fell back toward Richmond. Johnston was wounded, and President Davis chose General Robert E. Lee to replace him.

Jackson's Valley Campaign. The Confederate high command feared that McClellan would receive reinforcements from the numerous troops that had stayed behind to protect Washington. To prevent this, Stonewall Jackson launched his famous Valley Campaign along the Shenandoah Valley. He planned to make the Northerners think he was going to attack Washington. In a series of brilliant moves between May 4 and June 9, Jackson advanced up the Shenandoah Valley. His 17,000 men received the name "foot cavalry" because they marched so fast. They defeated several federal forces and drove to the Potomac River. Jackson soon had to retreat, but he had forced the Union government to withhold powerful reinforcements which McClellan had counted on.

Stuart's Raid. While Lee planned his strategy as the new commander of the Army of Northern Virginia, General J. E. B. Stuart led a remarkable cavalry raid. Jeb Stuart and his men galloped completely around the Union army in three days, losing only one man. Stuart's raid not only gained valuable information about Union troop movements but also boosted Southern morale.

The Seven Days. Lee planned a daring move to destroy McClellan's army, which lay straddled over the Chickahominy River. With his army reinforced by Jackson's men to 85,000, Lee fell on McClellan in a series of attacks called the Battles of the Seven Days. Several battles and skirmishes took place between June 25 and July 1. They included Mechanicsville, or Beaver Dam Creek (June 26), Gaines' Mill (June 27), Savage's Station (June 29), White Oak Swamp and Frayser's Farm, or Glendale (June 30), and Malvern Hill (July 1). The advantage shifted from side to side, but McClellan believed his forces were hopelessly outnumbered and finally retreated to the James River. The Northern high command soon ordered McClellan's army to northern Virginia, to be united with a force under General John Pope. McClellan was to command the combined army.

The South Strikes Back

Second Bull Run. Lee moved rapidly northward to attack Pope, stationed at Manassas, before McClellan's men could join him. Lee sent Jackson ahead to swing around behind Pope's army and force a battle. On August 29, Pope unsuccessfully attacked Jackson, sending in McClellan's troops as fast as they arrived by boat from the south. Meanwhile, Lee and General James Longstreet had arrived and joined Jackson. On August 30, Pope rashly attacked Lee's army, but a Confederate counterattack swept the Union forces from the field. The beaten federal army plodded back to Washington in a heavy rain.

Antietam, or Sharpsburg. The South hoped to gain foreign recognition for the Confederacy by winning a victory in Union territory. Lee invaded Maryland in September, 1862, with about 50,000 troops. This march served as the background for the legend recorded in John Greenleaf Whittier's poem "Barbara Frietchie" (see FRIETCHIE, BARBARA). The Southern commander divided his army and sent Jackson with 25,000 troops to capture Harpers Ferry. McClellan moved to meet Lee with about 90,000 men. On September 13, a Union soldier found a copy of Lee's orders to his commanders wrapped around three cigars at an abandoned Confederate campsite. Lee learned of this loss and took up a position at Sharpsburg, on Antietam Creek. But McClellan did not attack until September 17, giving the Confederate forces time to reunite after Jackson's success at Harpers Ferry. A series of powerful Union attacks almost cracked the Southern lines. But, at a crucial moment, the last of Lee's absent troops, headed by General A. P. Hill, arrived to save the day. Lee suffered heavy losses and had to retreat to Virginia. The Battle of Antietam, one of the bloodiest of the war, killed or wounded about 12,500 Northerners and almost 11,000 Southerners. The Confederate retreat gave the North the victory that Lincoln had waited for. The President announced the preliminary Emancipation Proclamation on September 22.

Fredericksburg. Lincoln lost patience with McClellan because he did not follow up the Union victory at Antietam. The President replaced him with General Ambrose E. Burnside, who decided to attack Lee at Fredericksburg, Va., on the Rappahannock River. The Confederates defended the town from a line of fortified hills called Marye's Heights. On December 13, Burnside's men tried to storm the hills in a brave but hopeless attack. More than 12,000 Union soldiers were killed or wounded, and the Northern army retreated. Burnside was relieved of command at his own request.

Chancellorsville. General Joseph "Fighting Joe" Hooker replaced Burnside as commander of the Army of the Potomac. By the spring of 1863, the army numbered 120,000. Lee, with 60,000 men, still held the Rappahannock line. Hooker planned to keep Lee's attention at Fredericksburg while he sent another force around the town to attack the Confederate flank. The movement began on April 27 and seemed about to succeed. But Hooker hesitated, and on April 30 withdrew his flanking troops to a defensive position at Chancellorsville. The next day, Lee left a small force at Fredericksburg and boldly moved to attack Hooker. He sent Stonewall Jackson to attack Hooker's right while he struck in front. The attack, on May 2, cut the Northern army almost in two, but Union troops managed to set up a defensive line. Hooker retreated four days later. But the Confederate victory cost the life of Jackson, Lee's ablest general, who was shot accidentally by his own men. His left arm had to be amputated, and Lee told Jackson's chaplain: " . . . He has lost his left arm, but I have lost my right arm." Jackson, wounded on May 2, died eight days later from pneumonia and the effects of the amputation.

Gettysburg. Lee, confident because of the victory, decided to invade the North again. In June, the Confederate army swung up the Shenandoah Valley route into Pennsylvania. The Army of the Potomac, now commanded by General George G. Meade, followed it northward. Both the enemy armies moved toward the little town of Gettysburg, although neither planned to fight there. Lee did not know exactly where the Union army lay, because his "eyes," Stuart's cavalry, had set out on a raid. The shooting began when a Confederate brigade, searching for badly needed shoes, ran into Union cavalry in Gettysburg on July 1. For the first three days of July, a Northern army of 90,000 men met a Southern army of 75,000 in the greatest battle ever fought in the Western Hemisphere.

On the first day, the two armies maneuvered for position. By the end of the day, Northern troops had settled south of the town in a strong defensive location that resembled an upside-down fishhook. Culp's Hill and Cemetery Hill, at the right, formed the barb of the hook. The front ran for 3 miles (5 kilometers) along Cemetery Ridge, and ended at two hills called Little Round Top and Round Top. Confederate forces occupied Seminary Ridge, to the west. On the second day, July 2, Lee tried to crack the Union left and roll up Cemetery Ridge. The attack crushed a Northern corps, but failed to occupy the ridge.

On July 3, Lee decided to aim directly at the Union center. After a fierce artillery duel, he ordered 15,000 men under General George E. Pickett to charge the Union lines. The men, marching in perfect parade formation, swept across an open field and up the slopes of Cemetery Ridge, ignoring the murderous enemy fire. Only a fraction of the troops reached the crest of the ridge. For 20 dreadful minutes they held their ground. Then they yielded to superior strength and fell back. One Confederate soldier summed up the situation: "It ain't so hard to get to that ridge. The hell of it is to stay there." Pickett's charge, often called "the high-water mark of the Confederacy," showed the hopelessness of frontal assaults over open ground against a strong enemy.

Lee withdrew his battered army to Virginia after the battle. Much to Lincoln's disgust, Meade made little effort to follow him, and the Confederate army escaped. Gettysburg proved to be a turning point in the war. Lee had lost more than 20,000 men dead and wounded. Never again would he have the strength to undertake a major offensive.

The War in the West, 1862-1864

In the Western theater of the war, the North struck early and hard in order to seize and control the Mississippi River. Success would split the Confederacy into two parts. The Northern forces totaled 100,000. General Henry W. Halleck commanded in Missouri and western Kentucky. General Don Carlos Buell led Union forces in eastern Kentucky. General Albert Sidney Johnston commanded Confederate forces in Kentucky. His command included an army in Arkansas under General Earl Van Dorn. The Southern forces in this Western region numbered about 70,000.

In the Mississippi Valley

Fort Henry and Fort Donelson. The center of the Confederate line rested on two forts, Henry on the Tennessee River and Donelson on the Cumberland River. If Union forces could capture these forts, the whole Confederate position in Kentucky and western Tennessee would collapse. General Ulysses S. Grant, commanding officer under Halleck in western Kentucky, grasped this fact. He easily captured Fort Henry in February, 1862, with the support of a fleet of ironclad ships. Grant then moved against Fort Donelson. The Confederate commander, General Simon Bolivar Buckner, asked for "the best terms of capitulation." Grant replied: "No terms except an unconditional and immediate surrender can be accepted." Fort Donelson was captured, with nearly 15,000 Confederate troops. The stumpy, silent general gained the nickname of "Unconditional Surrender" Grant, and became a national hero.

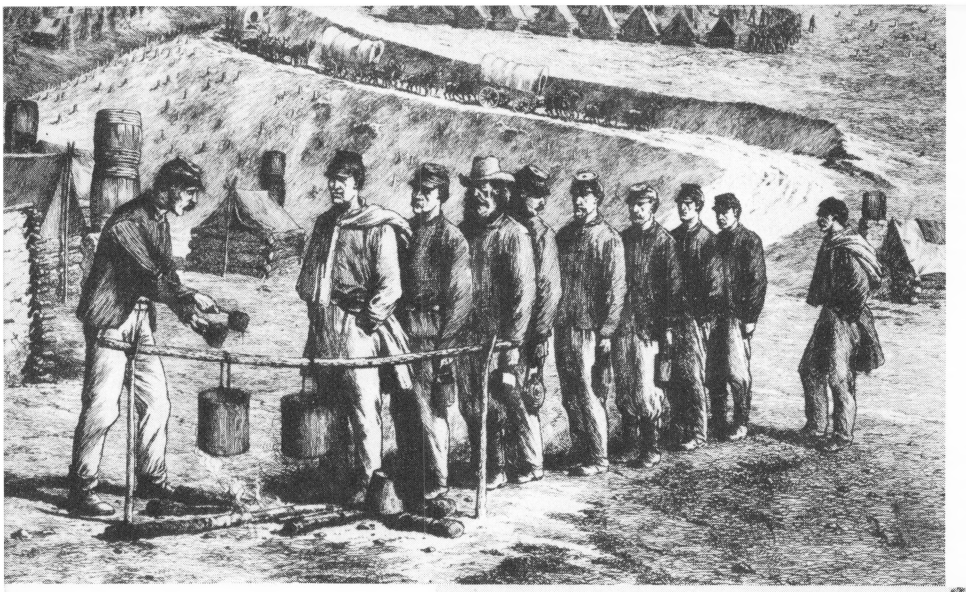
Grant's force lay between the two flanks of the Confederate army. To escape destruction, Johnston pulled back all the way to Corinth, Miss., an important railroad center. The Confederacy had now lost Kentucky and half of Tennessee. West of the Mississippi River, on March 6-8, a Union army under General Samuel R. Curtis defeated Van Dorn at Pea Ridge, Ark. This defeat put Missouri solidly in Northern hands.

Shiloh, or Pittsburg Landing. Halleck, now commander of all western Union forces, ordered Grant to move down the Tennessee River, and told Buell to join Grant. Grant and about 42,000 men moved to Pittsburg Landing, Tenn., 30 miles (48 kilometers) north of Corinth. Johnston and Beauregard decided that they had to strike Grant before Buell arrived. They planned to destroy Grant's forces with an army of 40,000. The Battle of Shiloh (named after a church on the battlefield) took place on April 6 and 7. On the first day, Confederate troops almost smashed Grant, but he held his lines. Johnston, the Confederate commander, was killed in the battle. The next day, with about 20,000 reinforcements from Buell, Grant forced the Southerners to retreat to Corinth. Many persons urged Lincoln to replace Grant after Shiloh, because of the heavy Union losses, which totaled more than 10,000. But Lincoln refused: "I can't spare this man—he fights!"

After Shiloh, Halleck took command of Grant's and Buell's forces, moved cautiously southward, and forced Beauregard to evacuate Corinth. By early June, the Union held the Mississippi River as far south as Memphis.

New Orleans. In the meantime, Northern forces were moving up the Mississippi from the South. In April, a naval squadron under Captain David G. Farragut appeared at the mouth of the river. Farragut steamed through the weak Confederate defenses, and forced New Orleans to surrender on May 1. Behind him came an army force under General Benjamin F. Butler, to occupy the South's largest city. Northerners held New Orleans and southern Louisiana for the rest of the war.

Raids. Some of the most daring exploits of the Civil War occurred behind the front lines. In April, 1862, a Union spy named James J. Andrews led 21 men



Winter Camp for Union soldiers provided few comforts. The men lived in crude huts and lined up outdoors for their food. Covered wagons, shown in the distance, carried food and supplies to the armies.

Etching (1876) based on a drawing (1864) by Edwin Forbes; Library of Congress, Washington, D.C., J. Pierpont Morgan Collection.

AT THE FRONT

Bomb Shelters protected picket posts near Atlanta. This one, built by Confederates, was later occupied by Union forces. The Civil War was the first to make wide use of dugouts and trench systems.

Library of Congress

through the Confederate lines to Marietta, Ga., where they captured a railroad engine, the *General*. They ran it northward toward Chattanooga, Tenn., destroying telegraph communications as they went. But Confederate troops in another engine, the *Texas*, pursued the *General* and caught it after an exciting chase. The Confederacy hanged Andrews and seven of his men.

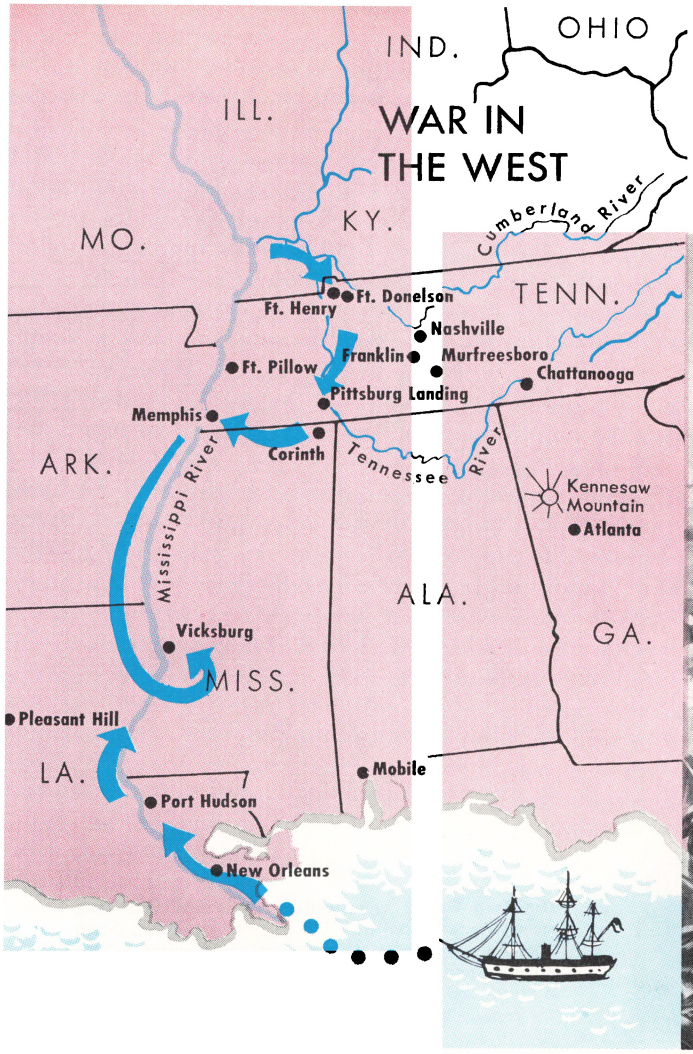
Two famous Confederate generals, Nathan Bedford Forrest and John Hunt Morgan, led many cavalry raids into Tennessee, Kentucky, Ohio, and neighboring states. Forrest's men galloped as far north as Paducah, Ky., destroying Union supplies and communication lines. "Morgan's Raiders" made an even more spectacular dash into Ohio in July, 1863. They destroyed property worth $500,000 before they were captured at Buffington Island. Morgan escaped in November, but was killed a year later in Tennessee.

Perryville. After Corinth fell to Union forces, Halleck went to Washington to act as Lincoln's military adviser. Before he left, he assigned to Grant, the best Union general yet to appear, the inactive job of guarding communications along the Mississippi River. Halleck ordered Buell, who had yet to prove himself, to capture Chattanooga. Before Buell could advance, General Braxton Bragg, the Confederate commander in Tennessee, suddenly invaded Kentucky. He wanted to draw the Northerners out of Tennessee. Buell raced to meet him, and the two armies met on October 8 in the Battle of Perryville. The result was indecisive, but Bragg retreated to Murfreesboro, Tenn.

Murfreesboro, or Stones River. Lincoln felt that Buell was too cautious, and replaced him with General William S. Rosecrans. Rosecrans advanced south from Nashville toward Bragg's army at Murfreesboro. A hard-fought battle dragged on from Dec. 31, 1862, to Jan. 2, 1863. Bragg retreated after losing 9,000 men. The battle brought into prominence a Union leader who later gained fame—General Philip H. Sheridan.

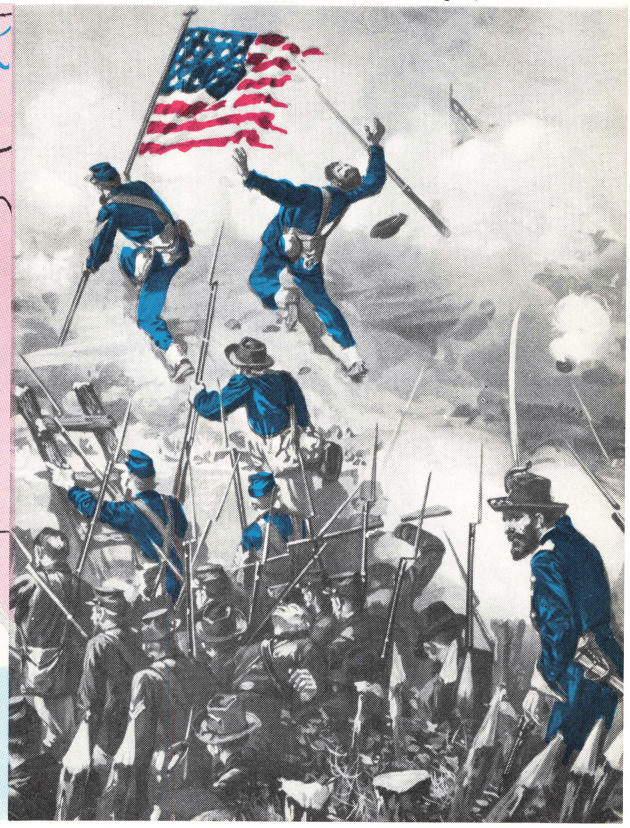
Vicksburg. In the winter of 1862-1863, Grant proposed to capture Vicksburg, the key city that guarded the Mississippi River between Memphis and New Orleans. At first, Grant tried to take Vicksburg from above, with naval support from Captain David D. Porter. But the ground north of Vicksburg was low and marshy, and the army bogged down. Grant's army tried several times to approach the city. Engineers even tried to dig a canal to divert the waters of the Mississippi so that troops moving down the river could bypass the city.

In April, 1863, Grant launched a new plan. Union gunboats and supply ships slipped past the Confederate batteries in the dead of night, and established a base on the river below the city. The army then marched



War in the West centered along the Mississippi River and in Tennessee, with Vicksburg and Chattanooga two of the main Union objectives. Soon after Grant's successful siege of Vicksburg, *below*, the North won the Mississippi.

Detail of a painting by Thure de Thulstrup; Library of Congress, Washington, D.C.



down the west side of the river and crossed over by ship to the eastern side. Grant had now reached dry ground below the city. In a brilliant campaign, he scattered Confederate forces in the field and drove toward Vicksburg. After direct attacks failed, Grant started to besiege the city in mid-May. The Confederate garrison held out for six weeks. People hid in caves during the constant bombardment, and ate mule meat. Vicksburg finally surrendered on July 4, the day after the Southern defeat at Gettysburg.

Five days later, Port Hudson, La., fell to Union forces under General Nathaniel P. Banks. The Confederacy had been split into two parts, and the North controlled the Mississippi. As Lincoln put it, "The Father of Waters again goes unvexed to the sea."

The Tennessee Campaign

Chickamauga. In the fall of 1863, Rosecrans advanced on Chattanooga with an army of 55,000 men. Bragg, seeking to keep his army free for action, evacuated the city and withdrew southward into Georgia. Rosecrans pursued him rashly. Bragg had received reinforcements from Virginia, and his forces numbered close to 70,000. He fell on Rosecrans savagely in the Battle of Chickamauga on September 19 and 20. The Northern right flank crumbled and broke completely. Only the left flank fought on under General George H. Thomas, who earned the nickname of "The Rock of Chickamauga." Rosecrans' entire Union army, badly mauled, eventually had to retreat into Chattanooga.

Chattanooga. Bragg did not follow up his victory immediately. He had lost 17,000 men. He finally advanced and occupied Lookout Mountain, Missionary Ridge, and other heights south of Chattanooga. From these points, Confederate artillery commanded the roads and the Tennessee River, which supplied the city. Starvation threatened the Northern army. But the North had enough manpower available in the West to meet any threat. Grant, now commander of all western forces, replaced Rosecrans with Thomas. Grant then advanced to Chattanooga with part of his own Army of the Tennessee. On November 23-25, the Northerners dealt Bragg a staggering blow in the Battle of Chattanooga. Lookout Mountain and other heights fell on the first two days. On November 25, Thomas' Army of the Cumberland, anxious to redeem its defeat at Chickamauga, swept up Missionary Ridge without orders. The successful charge ended the battle in an hour.

The Union had now won Chattanooga, the second objective of the western army. From this base, Northern armies could move into Georgia and Alabama and split the eastern Confederacy in two.

The Two Great Antagonists of the Civil War rank among the finest soldiers in U.S. history. Lee, *above*, shown after the surrender at Appomattox, was brilliant in both offensive and defensive operations. Grant, *left*, excelled in attack and directed the Union Army to victory.

Martin Schmidt; Sketch by A. R. Waud, Library of Congress

Grant and Lee, 1864-1865

All signs pointed to victory for the Union in early 1864. Northern resources seemed endless, while those of the South were fast giving out. Southern armies had dwindled in size because of battle losses, war weariness, and Northern occupation of large areas of the Confederacy. Southern railroads had almost stopped running, and supplies were desperately short. But the South, still capable of tough resistance, battled the North for more than a year before finally surrendering.

This last phase of the Civil War brought Grant into supreme command, and pitted him directly against Lee. In some ways, the final campaigns resembled a duel between the short, stocky Northerner in the shabby blue uniform and the tall, dignified, aristocratic Southerner in the perfectly tailored gray.

"If It Takes All Summer"

Early in 1864, Lincoln promoted Grant to the rank of lieutenant general and gave him command of all Northern armies. This appointment gave the North the advantage of coordinated strategy. Northern armies could now move, as Grant said, "like a team pulling together." Grant planned three main offensives. The Army of the Potomac, commanded by Meade, would try to defeat Lee in northern Virginia and occupy Richmond. Grant intended to accompany this army and largely direct its movements. An army under General William T. Sherman would advance from Chattanooga into Georgia and seize Atlanta. Banks would move from New Orleans to Montgomery, Ala., and later join Sherman. This third offensive never developed. Banks tried to fight his way up the Red River to capture Shreveport, La. But the Confederates under General Richard Taylor defeated him so badly in the Battle of Pleasant Hill on April 9 that he played no important part in the rest of the war.

The Wilderness. In May, the Army of the Potomac plunged into a desolate area of northern Virginia known as the Wilderness. This vast region of tangled forest and underbrush lay west of Chancellorsville. Grant, with 115,000 men, planned to march through the Wilderness, turn Lee's right flank, and force the Confederates into a decisive battle. Lee, with only 75,000 troops, marched to meet Grant on May 5, and the Battle of the Wilderness raged for two days. Troops stumbled blindly through the forest, where cavalry proved useless and artillery did little better. The underbrush caught fire, and wounded men died screaming in the flames. Both sides lost heavily, but Lee prevented Grant from turning the Confederate flank.

Spotsylvania Court House. In spite of heavy losses, Grant refused to turn back. He moved off to his left toward Richmond. Lee marched to meet him, and the great antagonists clashed again at Spotsylvania Court House on May 8-12. Spotsylvania, like the Wilderness, brought bloody losses but no victory for either army. Grant showed a dogged determination. He telegraphed to Halleck in Washington: "I propose to fight it out on this line if it takes all summer."

Cold Harbor. Again Grant moved off to his left toward Richmond, and again Lee followed. By June 1, Grant had reached Cold Harbor, just north of the Confederate capital. There, on June 3, he made another attempt to smash Lee. Northern troops charged in a direct frontal assault. Murderous fire cut down 6,000 men in one hour, and stopped the attack.

Cold Harbor forced Grant to change his strategy. Lee had demonstrated superb defensive skill, and Northern losses had reached staggering totals. In a month of fighting, Grant had lost almost 55,000 men. He felt that if he repeated his previous moves, Lee would fall back into the Richmond defenses where the Confederates could withstand a siege. So Grant made one more attempt to force a quick showdown battle.

Petersburg. Concealing his movement temporarily from Lee, Grant marched south and crossed the James River. His men built a pontoon bridge more than 2,000 feet (610 meters) long, one of the longest continuous pontoon bridges ever used in warfare. Then Grant advanced on Petersburg, a railroad center south of Richmond. All the railroads supplying the capital ran through Petersburg. If Grant could seize these roads, he could force Lee to come out and fight in the open. Grant almost succeeded. But a small Confederate force under Beauregard held him off until Lee arrived. Grant then realized that he could not destroy Lee's army without a siege. His men dug trenches around the city. Lee's weary troops did the same. The deadly siege of Petersburg began on June 20 and dragged on for nine long months.

Union troops tried several times to break through the Confederate line. The most unusual attempt, the Battle of the Crater, took place on July 30. Northern engineers had dug a 511-foot (156-meter) tunnel under the Confederate lines, and set off a gigantic powder charge at the end. The explosion blew a huge crater over 170 feet (52 meters) long. Northern soldiers poured forward, but milled about helplessly in the crater, at the mercy of Southern fire. The Confederates beat back the attack, which Grant called a "stupendous failure."

Cavalry Maneuvers. As Grant moved south toward Richmond, he sent his cavalry under Sheridan to attack the city's communications. The Confederate cavalryman Jeb Stuart opposed Sheridan. The forces met in the Battle of Yellow Tavern on May 11, and Stuart was killed.

In June, Lee sent an infantry force under General Jubal A. Early through the Shenandoah Valley to raid Washington. He hoped that Grant would send some of his troops to guard the capital. Early attacked one of the forts on the outskirts of Washington. During the fighting, Lincoln stood on a parapet as bullets spattered around him, the only President ever to be under enemy fire while in office. Early retreated to Virginia, but he remained a threat in the Valley.

Grant put all the Union forces in the Valley under Sheridan's command, and ordered "Little Phil" to follow Early to the death. Sheridan drove the Confederates from the region in a series of smashing victories. His greatest success came at Cedar Creek on October 19, when Early made a surprise attack while Sheridan was returning from a quick conference in Washington. Riding to the field from nearby Winchester, Sheridan rallied his men and won the battle. His exploit became famous in Thomas Read's poem "Sheridan's Ride." But he did not really ride 20 miles (32 kilometers), as the poem says, and the Confederate attack had been partly stopped before his arrival.

Mobile Bay. The blockade of Southern ports grew more and more effective. Union forces worked steadily to seize the main ports still open to blockade runners that slipped through the ring of Northern ships. In August, 1864, a naval squadron under Rear Admiral David G. Farragut sailed into the harbor of Mobile, Ala. Farragut was warned that the harbor bristled with mines, which were called torpedoes in those days. "Damn the torpedoes! Full steam ahead!" Farragut bellowed, and drove on. The Northerners did not occupy Mobile, but completely blockaded it. In January, 1865, the port of Wilmington, N.C., fell to Northern ships. But Charleston, S.C., still held out.

Closing In

The Atlanta Campaign. In May, while Grant drove into the Wilderness, Sherman's army of 90,000 advanced on Atlanta, Ga., from Chattanooga. General Joseph E. Johnston opposed him with a force of 60,000. Johnston planned to delay Sherman and draw him away from his base. He did not intend to fight unless his chances for victory were good. The summer of 1864 found the North discouraged and war-weary. The Confederacy hoped to stall for time until the November elections in the North, praying that Lincoln would lose. The Atlanta campaign developed into a gigantic chess game. Sherman moved forward, trying to trap Johnston. Each time, Johnston slipped away. The two armies clashed frequently in small battles. The largest battle occurred at Kennesaw Mountain, on June 27, and resulted in a Union setback.

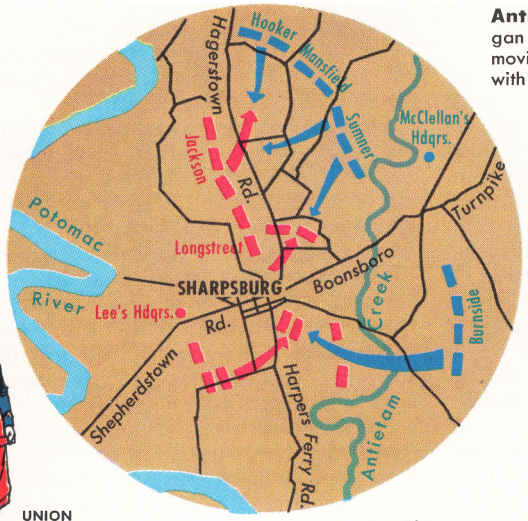
As Sherman reached the outskirts of Atlanta, President Davis decided that Johnston fought too cautiously, and replaced him with General John B. Hood. The new commander attacked the Union columns as Sherman approached Atlanta. But his attacks failed, and he took up a position in the city. Sherman at first tried siege operations. But he did not want to be delayed too long. So he wheeled part of his army south of the city and seized its only railroad, to cut Hood's supply line. Hood evacuated Atlanta on September 1, and Sherman occupied the city the next day. His victory helped Lincoln win re-election.

North to Nashville. Sherman's victory was not quite so complete as it seemed. His forces had captured Atlanta, an important industrial center and a possible base for another push into the South. But Hood's army began hit-and-run raids on Sherman's railroad communications with Chattanooga. Sherman thought it would be useless to chase Hood along the railroad.

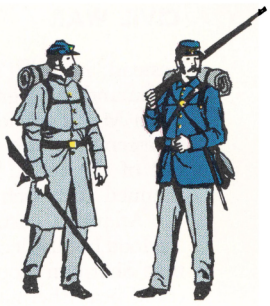
MAJOR BATTLES OF THE CIVIL WAR

This table lists the most important Civil War battles. Accurate casualty figures are almost impossible to obtain, and must usually represent a compromise between several conflicting estimates. Those given below are approximate totals of dead and wounded.

Battle	State	Date	Commanders		Casualties		Results
			North	South	North	South	
Antietam (Sharpsburg)	Md.	Sept. 17, 1862	McClellan	Lee	12,500	10,750	Confederate retreat gave Lincoln the occasion to announce the Emancipation Proclamation.
Bull Run (Manassas) First	Va.	July 21, 1861	McDowell	Beauregard	1,500	2,000	The North first realized the seriousness of the war ahead.
Second		Aug. 29-30, 1862	Pope	Lee	10,000	9,000	The South regained almost all of Virginia.
Chancellorsville	Va.	May 1-4, 1863	Hooker	Lee	11,000	10,000	Outnumbered Confederate forces defeated the Union, but Stonewall Jackson was killed.
Chattanooga	Tenn.	Nov. 23-25, 1863	Grant	Bragg	5,500	2,500	Union victory brought most of Tennessee into Northern hands.
Chickamauga	Ga.	Sept. 19-20, 1863	Rosecrans	Bragg	11,500	17,000	Southern victory trapped Rosecrans in Chattanooga.
Cold Harbor	Va.	June 3, 1864	Grant	Lee	6,500	1,500	Heavy losses forced Grant to change his tactics.
Fair Oaks (Seven Pines)	Va.	May 31—June 1, 1862	McClellan	Johnston	4,500	5,500	Confederate forces were driven back toward Richmond.
Fort Donelson	Tenn.	Feb. 16, 1862	Grant	Buckner	2,500	2,000	The North won its first important victory.
Fort Henry	Tenn.	Feb. 6, 1862	Grant	Tilghman	34	16	Initial success encouraged Grant's western campaign.
Franklin	Tenn.	Nov. 30, 1864	Schofield	Hood	1,000	5,500	Hood's Tennessee campaign failed to draw Sherman from Georgia.
Fredericksburg	Va.	Dec. 13, 1862	Burnside	Lee	12,000	5,500	A terrible defeat left the North dispirited.
Gettysburg	Pa.	July 1-3, 1863	Meade	Lee	17,500	22,500	Northern victory marked a turning point in the war.
Kennesaw Mountain	Ga.	June 27, 1864	Sherman	Johnston	2,000	270	In spite of Confederate success, Davis replaced Johnston with Hood.
Mobile Bay	Ala.	Aug. 5, 1864	Farragut	Buchanan	315	32	The North blockaded Mobile.
Murfreesboro (Stones River)	Tenn.	Dec. 31, 1862—Jan. 2, 1863	Rosecrans	Bragg	9,000	9,000	Southern forces failed to follow up an initial victory.
Nashville	Tenn.	Dec. 15-16, 1864	Thomas	Hood	3,000	3,000	Northern victory practically ended Southern resistance in the West.
Perryville	Ky.	Oct. 8, 1862	Buell	Bragg	3,500	3,000	Confederate troops abandoned Kentucky.
Petersburg, Siege of	Va.	June 20, 1864—Apr. 2, 1865	Grant	Lee	17,000	13,000	Months of trench warfare pinned Lee to a static defensive and depleted his forces.
Seven Days	Va.	June 25—July 1, 1862	McClellan	Lee	16,000	20,000	Richmond was saved from capture, and Northern forces retreated.
Shiloh (Pittsburg Landing)	Tenn.	Apr. 6-7, 1862	Grant	Johnston, Beauregard	13,000	10,500	A surprise attack spoiled Grant's plans for quick victory in the West.
Spotsylvania Court House	Va.	May 8-12, 1864	Grant	Lee	10,000	9,000	Southern resistance stiffened Grant's determination to win.
Vicksburg, Siege of	Miss.	May 19—July 4, 1863	Grant	Pemberton	9,000	10,000	Northern victory proved decisive in winning the Mississippi and the West.
The Wilderness	Va.	May 5-6, 1864	Grant	Lee	17,000	11,000	Heavy losses failed to halt Grant's progress southward.



Antietam. Four Union attacks began with Hooker's at 8 A.M. and, moving southward in order, ended with Burnside's in the afternoon.



UNION
Infantrymen

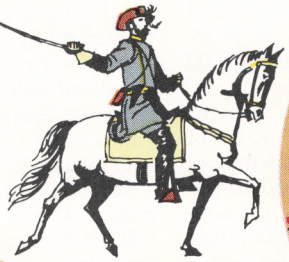
UNION
Zouave

UNION
General

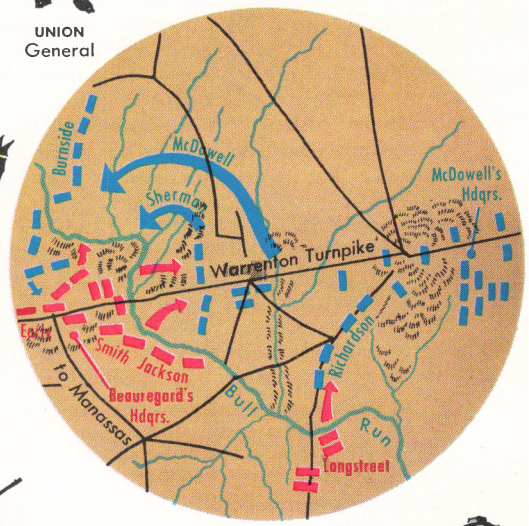
First Bull Run. Several Union forces hit the Confederate left flank, but were halted and forced back by Jackson, Smith, and Early.

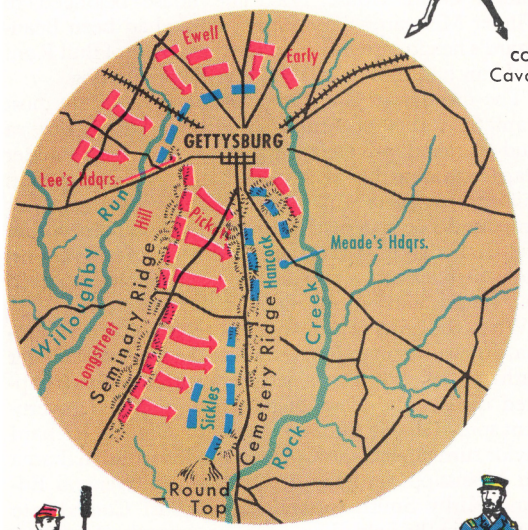
UNION FORCES

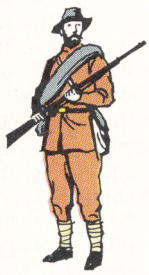
CONFEDERATE FORCES



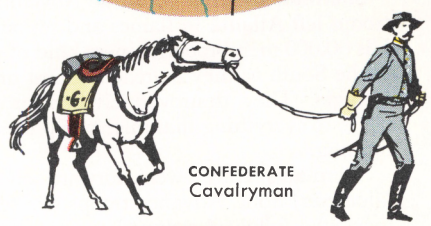
CONFEDERATE
Cavalry General



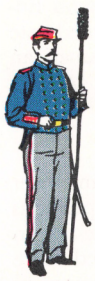




CONFEDERATE
Militiaman



CONFEDERATE
Cavalryman

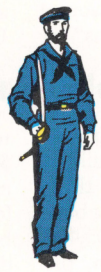


CONFEDERATE
Artilleryman

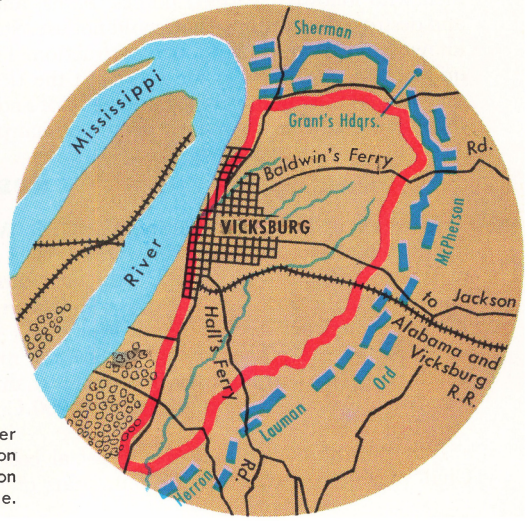
Gettysburg. On July 1, Confederates pushed Union troops south of the town. On July 2 and 3, Union armies repulsed several different attacks directed by Hill and Longstreet.

Captain

UNION
NAVY



Seaman



CONFEDERATE
Infantryman

Vicksburg. The Mississippi River then flowed past the city. Union troops crossed below it and won several battles before the siege.

Instead, he sent Thomas back to Tennessee to take command, and gave him 30,000 men under General John M. Schofield. He ordered Thomas, at Nashville, to assemble more troops in Tennessee and keep Hood out of the state. With his remaining men, Sherman planned to march across Georgia to Savannah, near the Atlantic Coast.

Hood boldly decided to invade Tennessee in the hope that Sherman would follow him. He felt sure that he could beat Sherman in the mountains. Then he would either invade Kentucky or cross into Virginia and join Lee. But Hood's plan was too big for his army.

Franklin. Hood might have scored a partial success if he had moved into Tennessee immediately. But he delayed his advance, and met Schofield's force at Franklin, Tenn., on November 30. Hood, an aggressive commander, had complained that his army had retreated so much under Johnston's command that it had forgotten how to attack. His generals now seemed determined to show him he was wrong. In six headlong charges, the Confederates lost more than 6,000 men, including 11 generals killed or wounded.

Nashville. Hood had no chance of success after his defeat at Franklin. But he took a position south of Nashville and waited. In the city, Thomas had time to gather an army of 60,000. He attacked Hood in the Battle of Nashville on December 15 and 16, and won one of the most smashing victories of the war. On their long retreat to Mississippi, Confederate soldiers sang a bitter song to the tune of "The Yellow Rose of Texas."

> "You may talk about your Beauregard
> And sing of General Lee,
> But the gallant Hood of Texas
> Played hell in Tennessee."

Sherman's March began on November 15, when his troops left Atlanta in flames and set out for Savannah. His 60,000 men brought a new kind of war to the heart of the South as they marched almost unopposed across Georgia. They destroyed civilian property and laid waste to everything that might help the South continue fighting.

Sherman's army swept forward on a 60-mile (97-kilometer) front. Advance troops scouted an area. The men who followed stripped houses, barns, and fields, and destroyed everything they could not use. Stragglers, known as *bummers*, caused much destruction. They tore up railroad tracks and made fires with the ties. Then they heated the rails until they were red-hot and wound them around trees to make "Sherman hairpins" or "Sherman neckties." Sherman estimated that his men destroyed $100 million worth of property in Georgia. He hoped this horrible destruction would break the South's will to continue the war.

Sherman occupied Savannah on December 21, and sent a message to Lincoln: ". . . General Sherman makes the American people a Christmas present of the city of Savannah with 150 heavy guns and 25,000 bales of cotton." From Savannah, the army swung into South Carolina, burning and plundering, and then into North Carolina. A small Confederate army under Johnston tried vainly to halt Sherman in his drive northward to Virginia and a link with Grant.

The South Surrenders. In Virginia, Grant at last achieved his goal. In April, 1865, he turned Lee's right flank and seized the railroads supplying Richmond. The Confederate troops had to evacuate Petersburg and Richmond. Lee retreated westward, hoping to join forces with Johnston in North Carolina. But Grant overtook him and barred his way. Representatives of the Union and Confederate governments had tried unsuccessfully to arrange for peace on February 3 (see HAMPTON ROADS CONFERENCE). Lee now realized that continued fighting would mean useless sacrifice of life. He wrote Grant asking for an interview to arrange surrender terms.

On Sunday, April 9, the two great generals met in a farmhouse at the little country settlement of Appomattox Court House, Va. The house belonged to Wilmer McLean, whose former home had been Beauregard's headquarters during the first Battle of Bull Run. McLean had moved south to avoid the fighting.

The meeting of Grant and Lee was one of the most dramatic scenes of American history. Grant wore a mud-spattered private's coat, with only his shoulder straps revealing his rank. Lee had put on a spotless uniform, complete with sword. Grant offered generous terms, and Lee accepted them with deep appreciation. The Confederate soldiers received a full day's rations, and were released on parole. They were allowed to keep their horses, and officers retained their side arms.

When the news of Appomattox reached North Carolina, Johnston surrendered to Sherman on April 26 near Durham. Jefferson Davis fled southward, and was captured in Georgia. News of the collapse of the government spread slowly through the South. General Richard Taylor surrendered the Confederate forces in Alabama and Mississippi on May 4. On May 26, General Edmund Kirby Smith surrendered the last Confederate army still in the field. The war to preserve the American Union was over.

Results of the War

In terms of human casualties, the Civil War cost more than any other American war. About 1 million men were killed or wounded. Deaths, including those from disease, totaled 529,332. By comparison, about 116,500 Americans died in World War I and 405,400 in World War II. The North lost 364,511 men, the South, 164,821. Disease killed more men than bullets did. About 140,000 Union men and 75,000 Confederates died in battle.

It is difficult to estimate the financial cost of the Civil War. Direct costs for the four years of fighting totaled more than $3 billion for the North and over $2 billion for the South. Indirect costs, such as pensions and interest on the national debt, burdened the nation for years after the war. Other expenses included those borne by state and local governments, the property damages caused by the war, and the value of freed slaves. The total cost for both sides probably exceeded $15 billion.

Some of the costs of the Civil War cannot be reckoned in terms of money. The South suffered the worst damage, because most of the fighting occurred there.

The war destroyed many Southern cities and towns. Farmlands and fine old homes lay in ruins. Railroads were shattered, and industry and trade had almost stopped. The economy of the South had almost completely collapsed. By comparison, the North suffered little physical damage.

Perhaps the most important result of the war was the heritage of hate that it left on both sides. Southerners were the only Americans to be defeated in war and to undergo military occupation. Some Southerners grew bitter in defeat, and some Northerners revengeful.

T. HARRY WILLIAMS. Critically reviewed by BRUCE CATTON

Related Articles. See the Places to Visit and History sections of the articles for those states which fought in the Civil War, such as VIRGINIA (Places to Visit; History). See also the following articles:

BIOGRAPHIES

NORTHERN MILITARY LEADERS

Burnside, Ambrose E.
Butler, Benjamin F.
Dahlgren, John A. B.
Farragut, David G.
Foote, Andrew H.
Grant, Ulysses S.
Halleck, Henry W.
Hancock, Winfield S.
Hooker, Joseph
Kearny, Philip
Logan, John A.
McClellan, George B.
Meade, George G.
Porter (David D.)
Porter, Fitz-John
Rosecrans, William S.
Schofield, John M.
Sheridan, Philip H.
Sherman (William T.)
Shields, James
Thomas, George H.
Wallace, Lew
Wilkes, Charles

SOUTHERN MILITARY LEADERS

Beauregard, Pierre G. T.
Bragg, Braxton
Breckinridge, John C.
Buckner (Simon Bolivar)
Early, Jubal A.
Ewell, Richard S.
Forrest, Nathan B.
Gordon, John Brown
Hampton, Wade
Hood, John B.
Jackson, Stonewall
Johnston, Albert S.
Johnston, Joseph E.
Lee, Robert E.
Longstreet, James
Morgan, John H.
Mosby, John S.
Pickett, George E.
Polk, Leonidas
Semmes, Raphael
Smith, Edmund Kirby
Stuart, James E. B.
Wheeler, Joseph

OTHER BIOGRAPHIES

Barton, Clara
Beecher (Henry Ward)
Benjamin, Judah P.
Bickerdyke, Mary A. B.
Boyd, Belle
Brady, Mathew B.
Brown, John
Buchanan, James
Chase, Salmon P.
Crane, Stephen
Davis, Jefferson
Douglas, Stephen A.
Lincoln, Abraham
Mallory, Stephen R.
Mason and Slidell
Memminger, Christopher G.
Randolph (George W.)
Reagan, John H.
Ruffin, Edmund
Seddon, James A.
Seward, William H.
Smalls, Robert
Stanton, Edwin M.
Stephens, Alexander H.
Walker, Leroy P.
Welles, Gideon
Whitman, Walt

CAUSES AND BACKGROUND

Abolitionist
Border State
Compromise of 1850
Crittenden Compromise
Dred Scott Decision
Fugitive Slave Law
Kansas-Nebraska Act
Missouri Compromise
Negro (Changing Status)
Nullification
Proslavery Movement
Slavery
Squatter Sovereignty
States' Rights
Uncle Tom's Cabin
Underground Railroad
Wilmot Proviso

EVENTS

Alabama (ship)
Emancipation Proclamation
Fort Sumter
Gettysburg, Battle of
Gettysburg Address
Hampton Roads Conference
Harpers Ferry
Monitor and Merrimack
Trent Affair

OTHER RELATED ARTICLES

Balloon (Balloons in War)
Battleground National Cemetery
Confederate Memorial Day
Confederate States of America
Dixie (song)
Flag (Changes in the United States Flag; pictures)
Frietchie, Barbara
Grand Army of the Republic
National Park System
Petersburg (pictures)
Reconstruction
Sons of Liberty

Outline

I. Causes of the War
- A. "A House Divided"
- B. "An Irrepressible Conflict"
- C. Secession

II. Mobilizing for War
- A. How the States Lined Up
- B. Rallying Round the Flags
- C. Johnny Reb and Billy Yank
- D. Negroes in the Civil War

III. The Home Fronts
- A. In the North
- B. In the South

IV. The War in the East, 1861-1864
- A. Opening Battles
- B. On to Richmond!
- C. The South Strikes Back

V. The War in the West, 1862-1864
- A. In the Mississippi Valley
- B. The Tennessee Campaign

VI. Grant and Lee, 1864-1865
- A. "If It Takes All Summer"
- B. Closing In

VII. Results of the War

Questions

Why has the Civil War often been called the first modern war?

How did the Emancipation Proclamation change the war aims of the North?

Why do many Civil War battles have two names?

How did the North and South compare in population at the beginning of the war?

What were (1) *Bounty jumpers?* (2) *Bummers?* (3) *Copperheads?*

What two important victories did the North win within a day of each other?

Why did the South usually wage defensive, rather than offensive, warfare?

What were the political consequences of the Battle of Antietam? The capture of Atlanta?

Who were the outstanding figures of the Civil War?

Reading and Study Guide

For a *Reading and Study Guide on the Civil War*, see the RESEARCH GUIDE/INDEX, Volume 22.

CIVIL WAR, ENGLISH. See ENGLAND (The Civil War); CHARLES (I) of England; CROMWELL, OLIVER.

CIVIL WAR, SPANISH. See SPAIN (History).

CIVILIAN CONSERVATION CORPS was an agency authorized by the government to hire unemployed young men for public conservation work. The corps was set up as part of the New Deal program in 1933. It provided training and employment. The CCC conserved and developed natural resources by such activities as planting trees, building dams, and fighting forest fires. More than 2 million men served in the CCC before Congress abolished it in 1942.

CIVILIZATION

CIVILIZATION means a way of life that is advanced enough to include living in cities. The word comes from the Latin *civis*, meaning *citizen of a city*. Primitive people who are not considered *civilized* have camps and villages as their largest communities. People who are civilized usually have a knowledge of writing. Their way of life also usually provides for a division of labor. This means that farmers, herdsmen, and fishermen produce food, while merchants, craftsmen, clerks, soldiers, and others furnish manufactured goods and services. Government, religion, and education are in the hands of kings, priests, judges, teachers, and officials. Most scholars consider that history begins with writing, and thus with civilization. The long period before history began to be recorded is called the *prehistoric* era.

We often refer to individual civilizations, such as Chinese civilization or Western civilization. In this sense, a civilization means the *culture* (way of life) of a certain people (see CULTURE). Any way of life, whether it be simple or complicated, can be called a culture. But only a complex culture can be called a civilization.

The Rise of Civilizations

People had much to learn before they became civilized. For about $2\frac{1}{2}$ million years, they got their food by hunting animals and collecting roots, berries, and other products of nature. Such food was often scarce. People had to move about constantly to find enough to eat. Usually they had no extra food to support specialists, and no time to develop skills and trades.

The first advance toward civilization came in the 8000's B.C., when man discovered he could get most of his food by raising livestock and growing plants. This discovery made it possible for groups of people to settle in villages as farmers and herdsmen. They began to weave cloth and make pottery in their spare time. They could afford to support a few specialists, because they had extra food. Priests helped reduce the villagers' fears and quarrels by uniting them in the worship of gods. Chiefs learned to keep peace between neighboring villages, and to protect travelers and merchants. Peace and order helped trade develop and encouraged the spread of new ideas.

The second advance came with the discovery of metals (see BRONZE AGE; IRON AGE). Metals gave craftsmen better tools, warriors better weapons, and merchants a useful medium of exchange. As trade and production grew, chiefs became kings. Priests, craftsmen, merchants, tax collectors, and soldiers settled around the royal court. Wealth and trade led to a need for accounting. People invented systems of mathematics and writing. Scribes and teachers became necessary. The courts grew into cities, where groups of specialists, stimulating each other, produced works of art. Science came into being as priests studied the movements of planets and the positions of stars in order to arrange calendars for planting crops.

Some persons have believed that civilizations grow up only in certain climates, or among certain races. Most of the world's great civilizations have risen in temperate climates. But some cultures, such as those of the Khmers in Cambodia and the Maya Indians in Yucatán, developed in wet, tropical regions. Several different races of men have created civilizations.

Cradlelands

The world's oldest civilizations arose independently. Later civilizations grew up mainly because of the spread of earlier civilizations to new areas. Historians generally consider four areas of the Eastern Hemisphere to be *cradlelands*, where the oldest civilizations arose. These regions had distinct advantages over other territories in food supply and in ease of transportation. The four cradlelands were (1) Egypt, (2) the Middle East, (3) the Indus Valley of what is now Pakistan, and (4) the Hwang Ho Valley of China.

Egypt. The ancient Egyptians lived on the banks of the Nile River, which had many fishes and waterfowl. They could travel and carry goods up and down the river in boats. They grew wheat and other crops in the rich silt deposited regularly each year by the flooding of the Nile, so they had no fear of variations in rainfall. Villages grouped together in independent districts called *nomes* dotted the riverbanks. In prehistoric times, the nomes were united into two kingdoms, Upper Egypt and Lower Egypt. By the dawn of Egyptian history, about 3000 B.C., they had joined in a single kingdom. Egyptian civilization soon took on individual characteristics, and remained essentially the same for 2,500 years. Great stone temples and pyramids still stand to remind us of the Egyptians' concern with death. The alphabetic part of their hieroglyphic writing helped shape our own alphabet.

The Middle East includes a sickle-shaped area, curving from the Mediterranean seacoast to the Persian Gulf, which used to be extremely fertile (see FERTILE CRESCENT). In the eastern part of this crescent lay Mesopotamia, the land between the Tigris and Euphrates rivers. Here the early Sumerians built up a civilization at about the time that Egyptian civilization arose. They too grew wheat, raised cattle and sheep, and worked metals brought from distant mines. They were organized into separate city-states. The Sumerians built palaces and towering temples of sun-dried brick, because their country had no stone. They developed cuneiform writing, written on clay with pointed sticks. A series of later peoples, including the Akkadians and Babylonians, took over Sumerian civilization and carried it throughout Mesopotamia. It spread more widely than Egyptian civilization, and influenced many others, including Western civilization. From it come our seven-day week and 360-degree circle.

Other Middle Eastern peoples learned much from the Sumerians, and added their own contributions. In the western part of the Fertile Crescent lived the Phoenicians, Aramaeans, and Hebrews. The Hittites established a kingdom in Asia Minor. In later years, the Assyrians and then the Persians united huge areas of the Middle East to form great empires.

Indus Valley. Around 2500 B.C., a people whose name we do not know established a civilization in the valley of the Indus River in what is now Pakistan. They built cities of fired brick with straight streets and good drains and sewers. They also worked bronze and wrote in an alphabet that has not yet been deciphered. Sumerian seals found in the ruins of such cities as Harappa and Mohenjo-daro show that the Indus Val-

ley people traded with Mesopotamia. Their civilization came to an end about 1700 B.C. Scholars are not certain of what led to the downfall of the civilization.

Hwang Ho Valley. Around 1500 B.C., a civilization arose on the banks of the Hwang Ho, a river in north-central China. Archaeologists have excavated a large city of the so-called Shang dynasty near An-yang. The people built palaces of wood, and cast the finest bronze vessels ever made. They also left the oldest Chinese writing yet found. This writing was engraved on scraps of bone used for telling fortunes. The early Hwang Ho culture is the only one of the several cradleland civilizations that has continued to the present day.

Mediterranean Civilizations

The Mediterranean Sea is the world's largest inland body of water. The people living along its shores and on its islands enjoy a mild climate and easy sailing conditions. Their civilization developed from the cultural contributions of Egypt, Mesopotamia, and the north.

Aegean. The earliest civilization along the Mediterranean, the Aegean, arose about 3000 B.C. The Minoans of Crete built beautiful cities, such as Knossos, with good plumbing and fine wall paintings. Scholars have deciphered some of their writing. The Minoans were good sailors and traders, and spread their goods and civilization throughout the eastern Mediterranean. Aegean civilization on the Greek mainland is often called *Mycenaean*, after its capital, Mycenae. Troy, in Asia Minor, had a related culture.

Greek civilization arose from a combination of Aegean civilization and the culture of invaders from the north. It reached its height by the 400's B.C. The Greeks wrote with a true alphabet derived from the Egyptians through the Phoenicians, and produced the world's first works of history and science. Their architecture and sculpture remain unsurpassed. Greek concepts of democracy and justice helped form those of Western civilization.

Roman. The citizens of Rome rose to power in central Italy during the 400's B.C., and gradually extended their empire until they controlled the region from Britain to Syria. The Romans absorbed elements of civilization from the Etruscans, Greeks, Egyptians, and other civilized peoples of antiquity. They blended these elements into a culture of their own. Roman achievements included the construction of paved roads and aqueducts, and the codification of a system of laws still used by many nations. Latin survived for hundreds of years as the speech of learned men, and formed the basis for today's Romance languages. The final collapse of the Roman Empire in A.D. 476 ended the period of ancient civilizations.

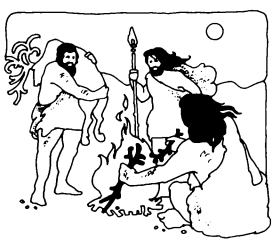
An offshoot of Greek and Roman civilization, the Byzantine Empire, preserved classical learning for a thousand years, and spread it to new areas in central and eastern Europe (see BYZANTINE EMPIRE).

Early American Indian Civilizations

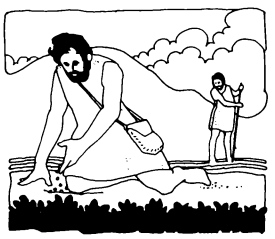
Several groups of Indians in North and South America attained a relatively high degree of civilization. They lacked most beasts of burden, and did not use wheels. Neither their cities nor their writing systems developed to a great degree. But they had made much progress

SOME IMPORTANT EVENTS IN THE DEVELOPMENT OF CIVILIZATION

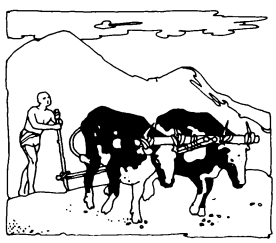
The development of civilization resulted from man's ability to control fire, plant crops, use animals, build permanent homes, use wheels and metals, write, and organize government.



Control of Fire brought man warmth and cooking and protected him from animals.

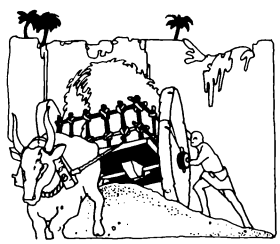


Cultivation of Crops supplied man with a dependable, unending source of food.



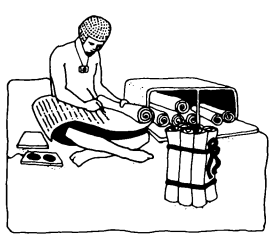
Domestication of Animals furnished man with a steady supply of labor and meat.

Permanent Dwellings followed man's learning to grow crops and raise animals.

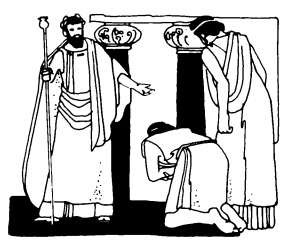


Discovery of the Wheel gave man a revolutionary means of transportation.

Use of Metals enabled man to make better, more durable tools and weapons.



Development of Writing enabled man to set his thoughts down in a lasting form.



Government brought order to human society and promoted the public welfare.

before the coming of the white man in the A.D. 1500's ended their civilizations.

Andean. Indians of the Andes Mountains area in South America began developing advanced ways of living about A.D. 400. They grew potatoes, beans, maize, and a local pigweed called *quinoa*. They domesticated the llama and the guinea pig. These peoples also invented bronze without contact with the Eastern Hemisphere, and cast beautiful objects of gold and silver. They wove intricate textiles of cotton, and of llama and alpaca wool. In the 1400's, the Inca united a large region into a single empire. Their stone walls remain among the wonders of the world, because they used huge single stones that fit closely together without mortar. The Inca paved roads and spanned mountain gorges with suspension bridges.

Mayan. Meanwhile, Indians in Guatemala and the lowlands of Yucatán and Honduras developed another American civilization. Maya culture reached its peak in the A.D. 700's. The people built beautiful limestone temples and produced fine paintings, sculpture, and pottery. They invented a calendar system based on the movements of the sun, moon, and planet Venus. They developed a hieroglyphic writing, and invented the mathematical concepts of zero and the place system.

Mexican. The Valley of Mexico, where Mexico City now stands, was the scene of another great cultural movement. Early peoples, among them the Toltec Indians, grew crops and built stone pyramids. The later Aztec Indians controlled much of central Mexico by the time Hernando Cortes and his men arrived in the early 1500's. The Aztec worked in metal, but also used stone tools. They had an elaborate priesthood, and sacrificed thousands of victims to their gods.

Later Civilizations in Asia and Africa

European invasions brought American Indian civilizations to a sudden end. But such contact did not halt the development of civilizations in Asia and Africa. These cultures had grown too big and had advanced too far in technology to be overthrown.

Chinese civilization has had an uninterrupted growth for more than 4,000 years. The Chinese live by intensive farming, with rice as their main food. They have their own system of ideographic writing. It is hard to learn, because it consists of thousands of characters. But it is easy to write, because each character represents a whole word. The Chinese developed movable type and gunpowder long before Europeans did. Chinese art has given the world beautiful porcelain, silks, jade, and architecture. The civilizations of Japan and Korea drew much of their inspiration from China.

Hindu civilization in India arose from a union of Aryan culture with the earlier Indus Valley civilization. India has often contained many different tribes and nations. Hindu civilization arose to accommodate many of them in a complex structure known as the caste system (see CASTE). Hinduism has a rich religious lore, and temples devoted to many gods and goddesses. Our numerals and the decimal system come from India by way of the Arabs. The Khmer Empire of Cambodia had a related civilization in the A.D. 800's, and left magnificent temples at Angkor Wat and other sites.

Islamic. About A.D. 570, a prophet named Mohammed was born in Mecca, a city in southwestern Arabia. He combined certain beliefs and teachings of the Jewish and Christian religions with old local beliefs and rites into a new faith called Islam, which recognized a single god, Allah. This strict faith spread quickly. Mohammed's followers moved north to Syria, Egypt, and Iraq, and then westward to Morocco and Spain and eastward to India, eventually reaching Indonesia and the Philippines. They developed a characteristic art by blending elements from many of these cultures (see ISLAMIC ART). Moslems took over the learning of classical Greece and translated into Arabic many works that might otherwise have been lost. The Moslems respected learning, and founded the first universities.

Western Civilization

Our own Western civilization arose in Europe out of many sources. It had its roots in Greek and Roman culture, with contributions from Celtic and Germanic peoples. Its religion, Christianity, came from Palestine.

Western civilization falls into several periods. The medieval period, or Middle Ages, followed the breakup of the Roman Empire. During this era, Greco-Roman civilization blended with Celtic and Germanic elements. The Crusades of the 1100's and 1200's introduced Islamic skills and learning. As the way of life grew more complex, a new period, the Renaissance, began in the 1200's. Europeans invented firearms, deep-water ships, and printing. They sailed to all parts of the world in the so-called Age of Exploration. In the 1700's, Europeans and Americans made great progress in science and industry, and introduced the Industrial Revolution. Western civilization in one form or another has since spread throughout most of the world, and has had a strong influence on almost all other cultures.

Theories About Civilization

Philosophers and historians have speculated for hundreds of years about the principles that underlie the rise and fall of civilizations. The philosopher G. W. F. Hegel said that states are individuals that pass the torch of civilization from one to another. During this process, civilization goes through three stages: the rule of a single despot, who alone is free; the rule of a single class, which alone is free; and the rule of all the people, who are all free. Karl Marx held that the transition from the second stage to the third comes about when working people learn discipline and regimentation, and organize themselves for political action.

Oswald Spengler, author of *The Decline of the West*, believed that civilizations are born, ripen, and die like living things. Spengler thought that modern Western civilization is dying, and will be replaced by a new civilization from Asia. Arnold Toynbee stated his challenge-and-response theory in *A Study of History*. He said that civilizations can arise only where the environment is just right to issue a challenge to a people, and when they are just ready to respond to it. According to Toynbee, civilizations collapse when the genius of the creative minority has gone.

Few historians try to measure civilizations on any definite scale to determine which is higher or lower. But we may measure certain aspects, such as the amount of energy used for various projects. If we compare the

manpower needed to haul stones for pyramids with the windpower captured by a ship's sails, and in turn with the energy released by atomic fission, we can see that people have progressed steadily from early times to the present. Despite local setbacks, civilization as a whole has grown continuously. CARLETON S. COON

Related Articles. For the story of man before civilization, see PREHISTORIC MAN. For a discussion of how we learn about early civilizations, see ARCHAEOLOGY. For the story of man's civilized progress, see WORLD, HISTORY OF. See also the following articles in WORLD BOOK:

ANCIENT CIVILIZATIONS

Aegean Civilization	Greece, Ancient	Persia, Ancient
Ancient Civilization	Hittite	Phoenicia
Assyria	Indus Valley Civilization	Roman Empire
Babylonia		Sumer
Egypt, Ancient		

EARLY AMERICAN INDIAN CIVILIZATIONS

Aztec	Maya	Toltec Indians
Inca	Olmec Indians	Zapotec Indians

PERIODS OF WESTERN CIVILIZATION

Exploration and Discovery	Middle Ages
Industrial Revolution	Renaissance

CIVITAN INTERNATIONAL, *SIHV ih tan,* is an association of civic service clubs throughout the United States and Canada that are dedicated to the task of developing better citizenship. Civitan strives to encourage fellowship, increase knowledge, and to render patriotic service to community, state, and nation. The motto of the organization is "Builders of Good Citizenship." Its program includes the care of orphaned and crippled children, aid to mentally retarded children, city improvements, aid to veterans, support of the "Get Out the Vote" campaign, and the control of crime. Civitan has about 35,000 members in more than 1,100 clubs. It also sponsors Civitan clubs at about 400 high schools and 50 colleges. It sponsors about 500 Boy Scout and Girl Scout troops. Chartered in 1920, Civitan has headquarters at 115 N. 21st Street, Birmingham, Ala. 35203. Critically reviewed by CIVITAN INTERNATIONAL

CLAIBORNE, WILLIAM CHARLES COLE. See LOUISIANA (Territorial Days).

CLAIBORNE'S REBELLION was a series of conflicts in the 1630's and 1640's in which William Claiborne, a Virginia fur trader, refused to accept the authority of Leonard Calvert, the governor of Maryland. Claiborne came to Virginia from England in 1621. He explored Chesapeake Bay and became interested in the Indian fur trade. Claiborne went to England and obtained a trading license in 1631. When he returned, he set up a trading post on Kent Island in Chesapeake Bay.

Under a charter issued to the Calvert family in 1632, Kent Island lay within the boundaries of Maryland. Claiborne refused to acknowledge the authority of the Calverts, and war broke out. Claiborne was forced out. But in 1644, with some Puritan settlers, he drove Calvert out and seized control of the colony. Oliver Cromwell ordered the restoration of the Calvert government in 1657, and Claiborne returned to Virginia. He played a prominent role in the affairs of the Virginia colony until he died in 1677. MARSHALL SMELSER

See also MARYLAND (Colonial Days).

CLAIM, in its general meaning, is a legal demand. It may be one that a person asserts without basis. Or it may be one that he is actually entitled to have satisfied. A claim may involve property, money damages, or any other legal right. In mining law, a claim is a piece of public land that a miner takes up for the purpose of extracting minerals. In patent law, the claim is the part of the patent application in which the applicant points out the improvement that he claims as his invention. See also COURT OF CLAIMS. EDWARD W. CLEARY

CLAIMS, COURT OF. See COURT OF CLAIMS.

CLAIR, RENÉ (1898-), is a French motion-picture director. In his early films, he used fantasy to poke fun at everyday life. He gained his first popular acclaim with the comedy *The Italian Straw Hat* (1927). When sound films arrived, Clair began directing musical comedies. He won praise for his creative use of sound in *Under the Roofs of Paris* (1929), *Le Million* (1931), and *Give Us Liberty* (1931).

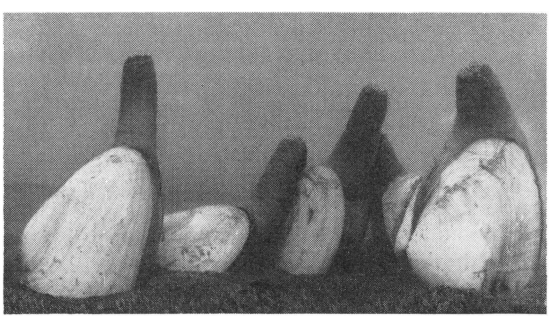
Clair was born in Paris. His real name was René-Lucien Chomette. During World War II, he worked in the United States where he directed the comedy *It Happened Tomorrow* (1944). He returned to France in 1946. His other comic films include *The Ghost Goes West* (1935), *Man About Town* (1947), and *The Grand Maneuver* (1955). In 1960, Clair became the first moviemaker to be elected to the French Academy. HARVEY R. DENEROFF

CLAIRVOYANCE, *klair VOY uhns,* is an awareness of events, objects, or people without the use of the senses of hearing, sight, smell, taste, or touch. It is a major form of *extrasensory perception* (*ESP*). If a person could locate a lost child or perform similar acts without using his known senses, he might be considered clairvoyant.

Clairvoyance supposedly is not affected by time or distance. A person may "see" an accident in a dream before it happens or sense an event taking place a great distance away. Awareness of an event before it occurs is known as *precognitive clairvoyance.* Clairvoyance is under scientific investigation, and the question of its existence remains open. Its relationship, if any, to telepathy is not known. WILLIAM M. SMITH

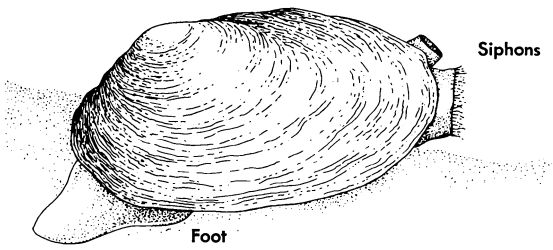
See also EXTRASENSORY PERCEPTION; TELEPATHY; MIND READING; PARAPSYCHOLOGY; PSYCHICAL RESEARCH.

CLAM is an animal whose soft body is covered with a protective shell. Clams live on the bottoms of oceans, lakes, and streams in many parts of the world. They feed on tiny water plants and animals called *plankton.* Clams have a large organ called a *foot,* which they use to burrow in mud or sand. Their shell is made up of two parts that are called *valves.* A *ligament* fastens the valves



L. W. Brownell

Soft-Shell Clams burrow deeply into the sand. When disturbed, they send out spurts of water and pull in their siphons.



WORLD BOOK illustration

A Clam uses an organ called a *foot* to burrow in mud or sand. The animal obtains food and oxygen from water that enters and leaves its body through two openings called *siphons*.

together. The growth lines on the valves show how the shell has enlarged from time to time. The *mantle*, a fleshy part of the body just inside the shell, secretes the shell material. The space between the main body of the clam and the mantle is called the *mantle cavity*. The clam has gills that hang into the mantle cavity.

Two openings at the back end called *siphons* allow water filled with food and oxygen to pass into the mantle cavity through the *ventral* (lower) siphon, and out again through the *dorsal* (upper) siphon. The clam's blood circulates through the gills, takes oxygen from the water, and gives off carbon dioxide. Tiny hairs on the gills fan the food particles to a small mouth and into the stomach. The food is digested in the stomach and passes into the intestine where most of it is absorbed. The clam has a heart and blood vessels. Other spaces in the clam's body in which the blood circulates are called *sinuses*.

Clams are valuable as food. The Indian name *quahog* is sometimes given to the hard-shell clam. This clam was used as *wampum* (money) by the Indians. It is a salt-water clam and is found in mud and sand from Canada to Florida. The meaty Pacific razor clam lives from California to the Aleutian Islands.

Soft-shell clams have a smooth, thin shell. They are found on tidal flats from South Carolina to Greenland. These clams burrow into the sand and have long siphons that extend above the sand into the water. Fishermen take great numbers of these popular food clams from the mud flats of New England.

Giant clams live on coral reefs in the East Indies and off Australia. Their shells may weigh over 500 pounds (230 kilograms) and may be 4 feet (120 centimeters) long. They feed on microscopic seaweeds.

Scientific Classification. The hard-shell clam belongs to the family *Veneridae*. The soft-shell clam is in the family *Myacidae*. The giant clam is a member of the family *Tridacnidae*. R. TUCKER ABBOTT

See also GOEDUCK; MOLLUSK; WAMPUM.

CLAN is a group of persons who are related through one line of descent from a common ancestor. Some clans are *matrilineal* (related through the female line). Others are *patrilineal* (related through the male line). Members of a clan feel a close relationship to each other, and usually have a strong spirit of unity. They often share property or special privileges. Most clans are *exogamous*. That is, the members must marry outside of the clan. Clans are often named after a *totem* (a symbolic animal or plant). American Indian tribes had clans such as the Bear clan or Tobacco clan.

The word *clan* also refers to groups of people in early Scotland and Ireland who had common ancestors and a common name, and were organized under the rule of a chief. These clans were *bilateral* (related through both men and women), and marriage within the clan was customary. The Scottish clans began about A.D. 1000. They carried on feuds in the Highlands, and clan members were expected to defend one another. Most clans lost power after the rebellion of 1745, but a spirit of clan loyalty remains among Scotsmen. They are distinguished by their names—such as the MacDonalds, the Campbells, and the MacGregors—and by their *tartans*, the plaids which clansmen wear as emblems of membership (see TARTAN). FRED EGGAN

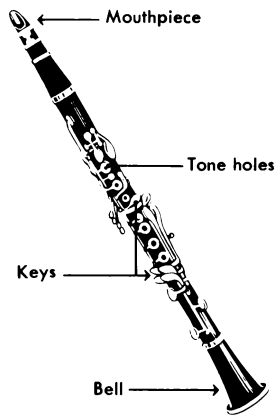
CLARENDON, EARL OF (1609-1674), played a leading part in restoring the monarchy in England in 1660. Clarendon originally sided with Parliament in its dispute with King Charles I, who tried to keep all political power for himself. But when civil war broke out in 1642, Clarendon joined the *Royalists* (supporters of the king). He insisted that the king represented the entire kingdom, not just a royal group.

Named lord chancellor in 1660, he tried to restore England to, in his words, "its old good manners, its old good humor, and its old good nature." But he was forced into exile in 1667. In exile he wrote the 10-volume *History of the Rebellion*, which defends the Royalist activities during the civil war. Clarendon was born Edward Hyde in Dinton, England. He studied at Oxford University. LACEY BALDWIN SMITH

CLARET. See WINE (Where Wine Comes From).

CLARINET, *KLAR uh NEHT*, is a single-reed woodwind instrument, usually made of wood but sometimes of metals or other materials. It serves as the leading instrument in military bands, corresponding to the violin in the orchestra. It is also important in the orchestra, and is sometimes used as a solo instrument. It consists of a cylindrical tube with a bell-shaped opening at one end and a mouthpiece at the other. A flat cane reed attached to the mouthpiece vibrates when the player blows on it. This vibration produces a full, rich tone. The tube contains open holes and holes covered by keys. The fingers open and close the holes and operate the keys to produce notes within a range of over three octaves. Clarinets are made in six or more sizes. Those most frequently used are the B-flat, A, E-flat alto, and B-flat bass clarinets. CHARLES B. RIGHTER

WORLD BOOK photo courtesy Chicago Symphony Orchestra



The Clarinet can produce full, rich tones over a range of about three octaves.

CLARION STATE COLLEGE. See UNIVERSITIES AND COLLEGES (table).

CLARK is the family name of two Americans—father and son—who held important government positions.

Tom Campbell Clark (1899-), the father, served as an associate justice of the Supreme Court of the United States from 1949 to 1967. He generally voted with the conservative group on the court. Clark became known for the clearness and preciseness of his written opinions on court decisions. He also took an active part in movements to improve the U.S. judicial system.

Clark was born in Dallas, Tex. He received A.B. and LL.B. degrees from the University of Texas. He joined the Department of Justice in 1937, and became assistant attorney general of the United States in 1943. President Harry S. Truman appointed Clark attorney general in 1945. He served in that position until 1949, when Truman named him to the Supreme Court.

Ramsey Clark (1927-), the son, served as attorney general of the United States from 1967 to 1969, under President Lyndon B. Johnson. Clark had been assistant attorney general from 1961 to 1965 and deputy attorney general from 1965 to 1967. In 1974, he ran as the Democratic nominee for U.S. senator from New York, but was defeated.

William Ramsey Clark was born in Dallas, Tex. He received a B.A. degree from the University of Texas, and A.M. and J.D. degrees from the University of Chicago. He wrote *Crime in America* (1970). H. G. REUSCHLEIN

CLARK, ABRAHAM (1726-1794), was an American political leader during the Revolutionary War, and a New Jersey signer of the Declaration of Independence. He served in the Second Continental Congress, in the Congress of the Confederation, and in the U.S. Congress. Clark was born in Elizabethtown, N.J. He won the title of *The Poor Man's Counselor* for his defense of poor farmers in land cases. CLARENCE L. VER STEEG

CLARK, ANN NOLAN (1898-), an author of children's books, received the Newbery medal in 1953 for *Secret of the Andes*. She won the Regina medal in 1963. In her work, Mrs. Clark shows an understanding of American Indians. She has taught Indian children and has written texts for them. Her books include *In My Mother's House* (1941), *Looking-for-Something* (1952), and *Santiago* (1955). Mrs. Clark was born in Las Vegas, N.Mex. She was an education specialist for the U.S. Bureau of Indian Affairs from 1930 to 1962. ELOISE RUE

CLARK, CHAMP (1850-1921), an American politician, became one of the best-known Democratic Party leaders of his time. A Missouri Democrat, he served 26 years in the U.S. House of Representatives between 1893 and 1921. He was speaker of the House from 1911 to 1919. Woodrow Wilson narrowly defeated Clark in 1912 for the Democratic presidential nomination.

James Beauchamp Clark was born near Lawrenceburg, Ky. He graduated from Bethany College in West Virginia in 1873, and from the Cincinnati Law School in 1875. NELSON M. BLAKE

CLARK, FRANCIS E. See CHRISTIAN ENDEAVOR.

CLARK, GEORGE ROGERS (1752-1818), an American soldier, won important victories in the Northwest Territory during the Revolutionary War. His victories gave the United States its chief claim to boundaries west to the Mississippi River and north to the Great Lakes in peace negotiations with England.

The Fall of Fort Sackville, detail of an oil painting by Frederick C. Yohn; William Henry Smith Memorial Library, Indiana Historical Society, Indianapolis

George Rogers Clark Captured Vincennes in 1779 by forcing the British to surrender Fort Sackville, which controlled the town.

Clark was born on Nov. 19, 1752, near Charlottesville, Va. When the Revolutionary War started, he was living in Kentucky, then a frontier district of Virginia. He served as a delegate in negotiations that resulted in the organization of Kentucky as a separate Virginia county. When denied military aid, he said that "if a country is not worth protecting, it is not worth claiming." This statement influenced the Virginia Council to send powder to Kentucky before the British and Indians attacked the settlers there.

England hoped to destroy the Kentucky forts and control all the region west of the Allegheny Mountains. The English supplied the Indians with arms to make war on the pioneers. Clark decided to carry the fight into the enemy's territory. With a small band of men, he captured Kaskaskia, Cahokia, and Vincennes, three British supply bases in the Illinois region. Clark could not get financial help to feed and pay his soldiers, so he used his own money. This left him penniless, but his action saved the Northwest Territory. When the peace treaty was signed in 1783, Britain surrendered the region to the United States (see NORTHWEST TERRITORY).

Thomas Jefferson once asked Clark to explore the land beyond the Mississippi River, but Clark refused. In 1803, his younger brother, William, accepted a similar request and became a leader of the Lewis and Clark Expedition (see CLARK, WILLIAM). WILLIAM O. STEELE

See also NATIONAL PARK SYSTEM (table: National Historical Parks).

CLARK, JIM (1936-1968), became one of the world's greatest automobile racing drivers. Clark won 25 Grand Prix races. Grand Prix races are road races held in many countries in which points are awarded to the top drivers. Clark won world racing titles in 1963 and 1965 by earning the most points in Grand Prix races. In 1963, he became the youngest driver ever to win the world title. He won seven Grand Prix races that year, and six Grand Prix races in 1965. He won the 1965 Indianapolis 500-mile Memorial Day race.

Clark was born in Fife County, Scotland. He began

racing in 1957. He was killed in a race in Hockenheim, West Germany, in April, 1968. HERMAN WEISKOPF

CLARK, JOSEPH SILL (1901-), a Pennsylvania Democrat, served in the United States Senate from 1957 to 1969. As mayor of Philadelphia from 1952 to 1956, Clark started an urban renewal program there (see PHILADELPHIA [History]). In the Senate, Clark became a leader of the liberals. His book, *Congress: The Sapless Branch* (1964), urged congressional reforms. He was born in Philadelphia. SYLVESTER K. STEVENS

CLARK, KENNETH BANCROFT (1914-), an American educator and psychologist, became known for his studies on school segregation and its effects on students. The Supreme Court of the United States referred to Clark's work in its 1954 ruling that "separate but equal" schools for blacks are actually unequal and therefore unconstitutional.

From 1939 to 1941, Clark participated in a study of the American Negro by the Swedish sociologist and economist Gunnar Myrdal. Clark became the first Negro to receive a permanent appointment as a professor at the City College of New York, where he has taught psychology since 1942. He has served since 1950 as a consultant to the National Association for the Advancement of Colored People (NAACP).

Clark was born in the Panama Canal Zone and earned degrees at Howard and Columbia universities. Two of his books are *Desegregation: An Appraisal of the Evidence* (1953) and *Dark Ghetto* (1965). RICHARD E. GROSS

CLARK, MARK WAYNE (1896-), was one of the top U.S. generals of World War II. Later, during the Korean War, he became United Nations commander in Korea. In 1953, he signed the military armistice agreement that ended the Korean fighting.

Clark was born in Madison Barracks, N.Y. He graduated from the United States Military Academy (West Point) in 1917, and served in Europe during World War I.

Clark commanded the U.S. Fifth Army in Italy from 1943 to 1944. In 1945, he became commander in chief of the U.S. forces in Austria, and U.S. High Commissioner for Austria. In 1952, he became the United Nations commander in Korea and U.S. commander in the Far East.

Clark retired from the Army in 1953. He wrote two accounts of his war experiences, *Calculated Risk* (1950) and *From the Danube to the Yalu* (1954). MAURICE MATLOFF

CLARK, RAMSEY. See CLARK (family).

CLARK, TOM CAMPBELL. See CLARK (family).

CLARK, WILLIAM (1770-1838), was an American soldier and explorer. He and Meriwether Lewis led an expedition that explored from the Louisiana Territory to the Pacific Coast from 1804 to 1806. The group started up the Missouri River in May, 1804. By boat, on horseback, and on foot, the men pushed north and west until they reached the Pacific Ocean. On the return trip, Clark explored the Yellowstone River to its mouth.

Before this expedition, Clark served in several campaigns against the Indians. In 1792, he became a lieutenant in the regular army and served under General Anthony Wayne. Clark resigned from the army in 1796, but joined it again in 1803 to go west with Lewis. Clark recruited and trained men for the hazardous trip. He mapped routes covered by the expedition and made sketches of the animal life along the way. Clark also assembled records of the journey and helped prepare them for publication.

Clark was born in Caroline County, Virginia. His brother was George Rogers Clark, a Revolutionary War hero. In 1807, William Clark became superintendent of Indian affairs at St. Louis, and in 1813 he became governor of the Missouri Territory. WILLIAM P. BRANDON

See also CLARK, GEORGE ROGERS; LEWIS, MERIWETHER; LEWIS AND CLARK EXPEDITION; SACAGAWEA.

CLARK, WILLIAM A. See MONTANA (Statehood).

CLARK UNIVERSITY. See UNIVERSITIES AND COLLEGES (table).

CLARKE, ARTHUR C. (1917-), is an author of science fiction. He is also known for his nonfiction books about scientific subjects.

Many of Clarke's science-fiction novels describe man's exploration of other worlds. Some of his stories tell of man's mystical search in outer space for superior intelligence that would help humanity. Clarke's novels include *Against the Fall of Night* (1953), *Childhood's End* (1953), and *The Deep Range* (1957). A collection of his stories was published as *The Nine Billion Names of God* (1967). Clarke's nonfiction, such as *The Exploration of Space* (1951), deals largely with the future of space travel or with life in the ocean, as in *The Challenge of the Sea* (1960).

Arthur Charles Clarke was born in the county of Somerset, England. He originated the idea of communications satellites in a scientific paper written in 1945. Clarke and Stanley Kubrick, the director, were coauthors of the screenplay for the motion picture *2001: A Space Odyssey* (1968). JUDY-LYNN BENJAMIN DEL REY

CLARKE, JAMES PAUL (1854-1916), served as a United States senator from Arkansas from 1903 to 1916. He won recognition as an independent Democrat, and served as president *pro tempore* of the Senate in 1913. Clarke advocated strict railroad regulation, and independence for the Philippines.

Clarke was born in Yazoo City, Miss. He held several state offices, and was governor of Arkansas from 1895 to 1897. A statue of Clarke represents Arkansas in the U.S. Capitol in Washington, D.C. NELSON M. BLAKE

CLASS, in biology. See CLASSIFICATION.

CLASS ACTION is a judicial proceeding in which one or more individuals sue on behalf of a group having similar claims. Such a group is called a *class*. Suppose that many consumers had to pay an unreasonably high price for a product because its few producers agreed illegally to charge similar prices. Most purchasers could not afford an individual lawsuit to recover the overcharge. But they might pool their claims and file a class suit to collect damages from the companies.

In the United States, people first used class suits to recover money owed them in bankruptcy cases. During the 1950's and 1960's, civil rights groups used class action to fight school segregation, job discrimination, and housing and voting restrictions. During the 1970's, some class actions attacked price fixing. Suits were also filed by environmental-protection groups to protest oil spills and other public nuisances. G. W. FOSTER, JR.

CLASSIC CAR. See AUTOMOBILE (The Classic Car [with pictures]).

CLASSICAL POETRY. See POETRY (The Three Traditions).

CLASSICISM is a philosophy of art and life that emphasizes order, balance, and simplicity. The ancient Greeks were the first great classicists. Later, the Romans, French, English, and others produced classical movements. Each group developed its own unique characteristics, but all reflected certain common ideals of art, man, and the world.

The Qualities of Classicism

Classicism contrasts with the philosophy of art and life called *romanticism*. Classicism stresses reason and analysis, while romanticism stresses the use of the imagination and the emotions. Classicism seeks what is universally true, good, and beautiful. Romanticism seeks the exceptional and the unconventional. Classical art reflects the artist's attempt to live in harmony with society. Many romantics are rebels. Classical artists follow formal rules of composition more closely than romantic artists. See ROMANTICISM.

Classicists know that reality is complex. However, they try to approach it through simple structures. For example, the classical playwright concentrates on essentials by following the formal unities of time, place, and action. This means he restricts his play to a single line of action that could happen within one day, in one place or in nearby places.

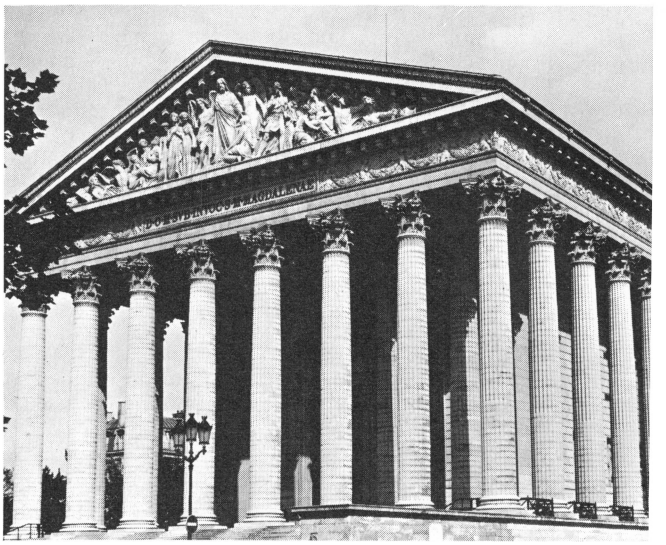
The French artists Nicolas Poussin and Jacques Louis David painted pictures illustrating the finest qualities of classical art. Both painters carefully balanced their compositions. Many of their pictures have a poetic mood, but the organization of the subject matter is always restrained and orderly. These qualities can be seen in David's *The Oath of the Horatii* and Poussin's *St. John on Patmos*. Both of the pictures are reproduced in color in the PAINTING article. The works of the Italian composer Giovanni Palestrina show the classical qualities of balance and clarity.

Great Classical Movements

A classical movement develops when a spirit of order and refinement joins with a previously developed spirit of intense thought, action, and passion. The most important classical movements in western culture developed in Greece and Rome during ancient times, and in Western Europe during the 1600's and 1700's.

Greece. The first classical period in the West arose in ancient Greece, and reached its height in the 400's and 300's B.C. The Greeks praised reason and denounced emotionalism, excess, and exaggeration. They tried to see all reality within a unified system that gave it meaning and direction. Greek artists showed beauty on a human rather than a supernatural scale. The sculptures of Phidias and Praxiteles are magnificent examples of proportioned human figures. Aeschylus, Sophocles, and Euripides wrote tragedies that show the value of moderation and the danger of excessive pride. See GREEK LITERATURE; GREECE, ANCIENT (The Arts).

Rome. Roman classicism developed in two stages—the age of Cicero from 80 B.C. to 27 B.C., and the age of Augustus from 27 B.C. to A.D. 14. The Romans adopted the Greek classical values, and added a unique emphasis on civilization as an organized, cooperative undertaking. Under the influence of the statesman and orator Cicero, civic responsibility gained a new importance. There was a new concern for the family, the role of women, and the well-being of the state. Rome's literature reached its highest achievement during the reign of Augustus Caesar. Almost all writers were classicists. The classical poet Virgil wrote works intended in part to reform public morality and thinking. During the Augustan age, the romantic poet Catullus was the only important artist deeply concerned with the feelings of the individual. See LATIN LITERATURE.



Ewing Galloway

The Influence of Classicism is reflected in the design of the Church of the Madeleine in Paris. Built in the style of a Roman temple, the Church of the Madeleine was begun about 1806 and was completed about 35 years later.

France. The French classical movement of the 1600's developed the most diverse expression of classical values ever seen in the western world. French classicists placed especially strong emphasis on reason and the intellect in analyzing ideas and human actions. The most important persons in the intellectual and literary history of the period include the mathematician-philosophers Blaise Pascal and René Descartes, the moralist writer Duc de La Rochefoucauld; the writer of fables Jean de La Fontaine; and the dramatists Pierre Corneille and Jean Racine. See FRENCH LITERATURE (The 1600's—The Classical Age).

England. The English classical period followed French classicism. It arose in the late 1600's and reached its height during the first half of the 1700's. The English called their movement *neoclassicism*, modeling it on the classicism of France, Greece, and Rome. For a more detailed discussion of English classicism, see ENGLISH LITERATURE (The Classical Age [1660-1798]).

Germany. In Germany and in German-speaking Austria, music rather than literature best expressed classical ideals. Ludwig van Beethoven, Joseph Haydn, and Wolfgang Amadeus Mozart rank among the great classical composers (see MUSIC [The Later 1700's]). In the late 1700's in Germany, a classical literature flourished side by side with romantic literature. Gotthold Lessing was the outstanding classical writer. HOWARD LEE NOSTRAND

CLASSIFICATION

CLASSIFICATION is the arrangement of objects, ideas, or information into groups. The members of each group have one or more characteristics in common. They may be the same size, shape, or color. They may come from the same place, have the same ancestors, or be classified according to their use. Classification makes things easy to find, and helps in the study of objects or information.

Most of the things we use daily are grouped in some kind of classification. We separate garden tools from work tools, and glassware from pots and pans. Supermarkets keep dairy products in one place, canned goods in another, and fresh meats in still another. Telephone directories list businesses in classified sections.

Scientific Classification is a method scientists have developed to arrange all animals and plants in related groups. It is the orderly arrangement of all living things. It indicates certain relationships among animal groups and among plant groups. Detailed classifications also show how ancient and extinct animals and plants fit into this arrangement. The classification of animals and plants is a science called *taxonomy* or *systematics*.

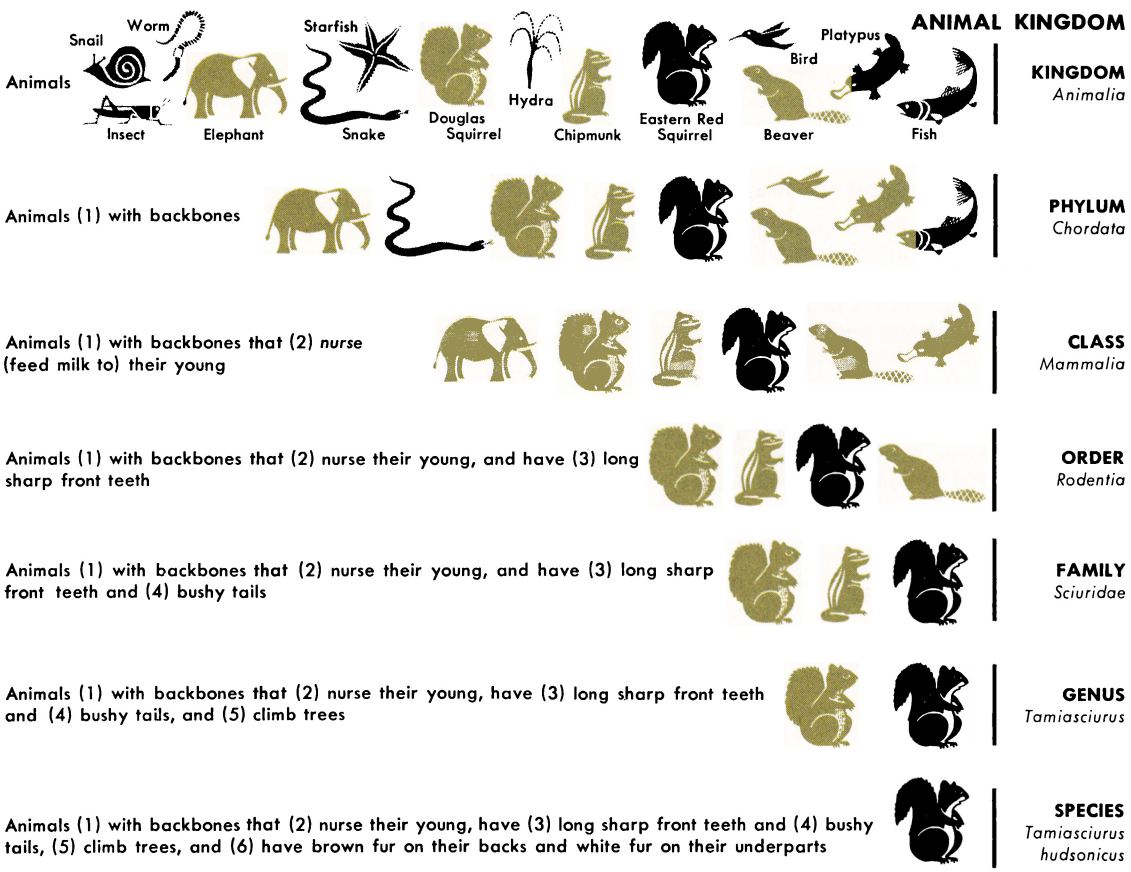
Scientific classification is an interpretation of facts. It is based on the opinion and judgment a biologist forms after studying specimens of animals and plants. Most biologists use the same basic framework for classification, but not all biologists agree on how individual animals and plants fit into this scheme. Because biologists differ, classifications often differ in details.

Richard G. Van Gelder, the contributor of this article, is Associate Curator and Chairman of the Mammalogy Department of the American Museum of Natural History.

The Language of Classification. Latin and Greek words are used in scientific classification, because early scholars used these languages. Every known animal and plant has a Latin or Greek name that has two parts. We call this the *binomial system of nomenclature*, or *binomial nomenclature*. These are Latin terms that mean *two-name naming*. The two names identify an animal or

HOW ANIMALS AND PLANTS ARE CLASSIFIED

The illustrated tables, *below*, are simplified examples of classification. They show how an Eastern red squirrel (*Tamiasciurus hudsonicus*) and a common buttercup (*Ranunculus acris*) can be separated from any other species of animal or plant. As you go down the tables, from kingdom to species, the animals and plants in each group have more and more features in common. The captions at each level enumerate these features. Individuals in a species have so many similar features that they look alike.



a plant in much the same way that your first and last names identify you.

Animals or plants are known by different common names in different regions. But each has only one correct scientific name, and scientists anywhere in the world can recognize an animal or plant by its scientific name. For example, the same large member of the cat family may be known in various parts of North and South America as a puma, cougar, mountain lion, panther, or león. The cat's scientific name is *Felis concolor*. A scientist can identify the animal by that name no matter what language he speaks.

An international commission of scientists establishes the rules for adopting scientific names. Some scientific names are descriptive. The scientific name of the spotted skunk, for example, is *Spilogale putorius*, which means *smelly, spotted weasel*. But many scientific names have no descriptive meaning.

Groups in Classification. Seven chief groups make up a system in scientific classification. The groups are: (1) kingdom, (2) phylum, (3) class, (4) order, (5) family, (6) genus, and (7) species. The kingdom is the largest group, and the species is the smallest. Every known animal and plant has a particular place in each group.

Kingdom contains the most kinds of animals or plants. All animals belong to the animal kingdom, *Animalia*. All plants are members of the plant kingdom, *Plantae*.

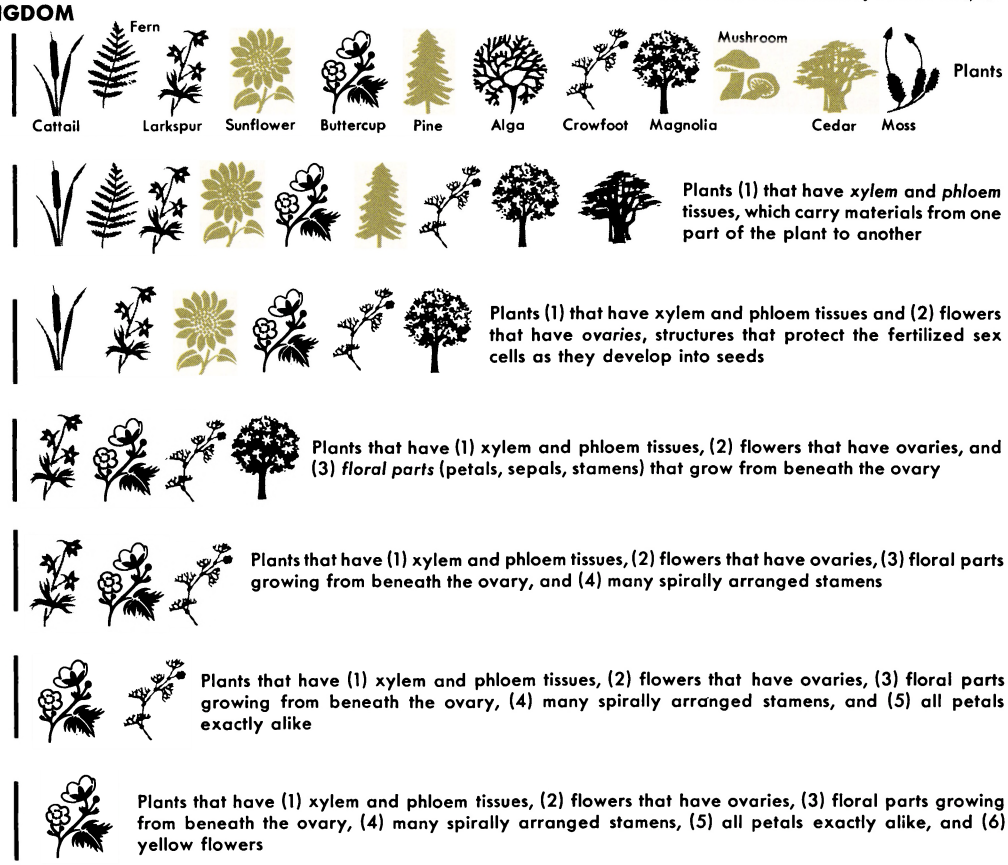
However, some living things so small that they can be seen only under a microscope seem to have some of the characteristics of animals and some of plants. So some scientists classify them in a special kingdom called *Protista*. Other scientists separate them into two kingdoms: the *Protista* or protists, and the *Monera* or monerans. In this classification, the monerans include bacteria and blue-green algae, which are sometimes considered plants. The protists are one-celled creatures, some of which are other kinds of algae, and others are protozoans, which are sometimes considered animals.

Phylum is the second largest group. The animal kingdom may be divided into 20 or more phyla. All animals with backbones belong to the phylum *Chordata*. The plant kingdom has 10 phyla. All plants that have tissues that transport materials from one part of the plant to another belong to the phylum *Tracheophyta*.

Class members have more characteristics in common than do members of a phylum. For example, mammals, reptiles, and birds all belong to the phylum *Chordata*. But each belongs to a different class. Apes, bears, and mice are in the class *Mammalia*. Mammals have hair on their bodies and feed milk to their young. Reptiles, including lizards, snakes, and turtles, make up the class *Reptilia*. Scales cover the bodies of all reptiles, and none of them feed milk to their young. Birds make up the

WORLD BOOK illustrations by John M. Bolt, Jr.

PLANT KINGDOM



class *Aves*. Feathers grow on their bodies, and they do not feed milk to their young.

Order consists of groups that are more alike than those in a class. In the class *Mammalia*, all the animals produce milk for their young. Dogs, moles, raccoons, and shrews are all mammals. But dogs and raccoons eat flesh, and are grouped together in the order *Carnivora*, with other flesh-eating animals. Moles and shrews eat insects, and are classified in the order *Insectivora*, with other insect-eating animals.

Family is made up of groups that are even more alike than those in the order. For example, wolves and cats are both in the order *Carnivora*. But wolves are in the family *Canidae*. All members of this family have long snouts and bushy tails. Cats belong in the family *Felidae*. Members of this family have short snouts and short-haired tails.

Genus consists of very similar groups, but members of different groups usually cannot breed with one another. Both the coyote and the timber wolf are in the genus *Canis*. But coyotes and timber wolves generally do not breed with one another.

Species is the basic unit of scientific classification. Members of a species have many common characteristics, but they differ from all other forms of life in one or more ways. Members of a species can breed with one another and the young look like the parents. No two species in a genus have the same scientific name. The coyote is *Canis latrans*, and the timber wolf is *Canis lupus*. Sometimes groups within a species differ enough from other groups in the species that they are called *subspecies* or *varieties*.

Development of Classification. For thousands of years man has tried to classify animals and plants. Early man divided all living things into two groups: (1) useful, and (2) harmful. As man began to recognize more kinds of living things, he developed new ways to classify them. One of the most useful was suggested by the Greek philosopher and naturalist Aristotle (384-322 B.C.). Only about a thousand animals and plants were known in his time. He classified the animals as those with red blood (animals with backbones) and those with no red blood (animals without backbones). He divided the plants by size and appearance as herbs, shrubs, or trees. Aristotle's scheme served as the basis for classification for almost 2,000 years.

The English biologist John Ray (1627-1705) first suggested the idea of species in classification. But the basic design for modern classification began with the work of the Swedish naturalist Carolus Linnaeus (1707-1778). Linnaeus separated animals and plants according to their *structure* (arrangement of parts), and gave distinctive names to each species. Biologists still rearrange classification, but today, our classification method is based on the principles that Linnaeus established. RICHARD G. VAN GELDER

Related Articles in WORLD BOOK include:

Animal (table: A Classification)
Botany
Family
Flower (table: Families)
Genus
Kingdom
Linnaeus, Carolus
Order
Phylum
Plant (table: A Classification)
Species

CLAUDE (1600-1682), a French painter, became a founder of the European landscape tradition. His paintings of the Roman countryside, with golden light slanting across fields, captured the visual imagination of European landscape painters for almost 150 years.

Claude often sketched outdoors from sunrise to sunset, watching the effects of changing light on the landscape. But he painted his canvases in his studio, organizing trees, streams, mountains, and fields into carefully planned artificial scenes. The human figures in the foregrounds were probably painted by others.

Claude confined himself to a rather narrow range of greens, blues, and golden browns. But he used these colors so skillfully that the effect of late afternoon light is instantly suggested.

Claude was born at Chamagne, France, in the province of Lorraine. His real name was Claude Gellée, but he took the name of his province and is sometimes called Claude Lorrain. Claude was orphaned as a child and wandered through Europe for several years. In 1627, he settled in Rome. He lived and painted there until his death. JOSEPH C. SLOANE

CLAUDEL, PAUL (1868-1955), became one of the foremost French poets and playwrights in the 1900's. His writings are examples of the Catholic revival in French art and literature. He expressed his deep religious faith in such poems as *Cinq Grandes Odes* (1910) and in his plays, of which the most famous is *Tidings Brought to Mary* (1912). Claudel also had a long diplomatic career as a consul and ambassador in China, Japan, Germany, Italy, and the United States. Claudel was born in France. WALLACE FOWLIE

See also FRENCH LITERATURE (The Four Masters).

CLAUDIUS (10 B.C.-A.D. 54) was the emperor of Rome from A.D. 41 to 54. Claudius was an excellent ruler. He formed a civil service system that placed specialized bureaus, headed by secretaries, in charge of the various branches of government. He built aqueducts, drained marshes, and made a harbor at Ostia, a town near Rome. Claudius conquered parts of England, and the Balkan Peninsula (then called Thrace). He also granted citizenship to certain persons in Rome's provinces.

Claudius was born in Lugdunum (now Lyon), France. His full name was Tiberius Claudius Nero. Lame and a stutterer, Claudius was kept from public view in his youth. He spent his time studying and writing histories of Etruria and Carthage. Claudius married several times. When he married his niece Agrippina the Younger, he adopted her son Nero. Some historians believe Agrippina murdered Claudius so that Nero could become emperor (see NERO). MARY FRANCIS GYLES

CLAUSE is a group of words with a subject and a predicate. A complete sentence is called a *main*, or *independent*, clause. For example, *we were practicing* is a main clause. A *subordinate*, or *dependent*, clause begins with a relative pronoun, such as *which*, *who*, or *that;* or with a subordinating conjunction, such as *although*, *if*, *because*, *so that*, *unless*, or *while*. Thus, *when we were practicing* is a subordinate clause.

Subordinate clauses are classified as *restrictive* or *nonrestrictive*. A restrictive clause is binding upon the word it modifies. To omit it would alter the meaning of the sentence. In "The man *who was coming toward me* suddenly stumbled," the subordinate clause is restrictive because it tells us who stumbled. A nonrestrictive clause

can be omitted without changing the sentence's essential meaning. In "George, *who was coming toward me*, suddenly stumbled," the clause is nonrestrictive. The word "George" tells us who stumbled. The clause places no further restrictions upon the subject. It merely adds information. Nonrestrictive clauses are enclosed by commas. Restrictive clauses are not. WILLIAM F. IRMSCHER

See also SENTENCE.

CLAUSEWITZ, *KLOW zuh vits*, **KARL VON** (1780-1831), a Prussian military author, wrote *On War*, one of the most important books on military matters. He was the first to make a complete study of all aspects of warfare. He stressed the importance of political, social, and personal factors, as well as strategy, tactics, and training. His military ideal was total destruction of the enemy. Clausewitz was born in Burg, Prussia, the son of a Prussian military officer. He began his military career when he was 12. In 1818, he became director of the General War Academy. ROBERT G. L. WAITE

CLAUSIUS, *KLOW zee uhs*, **RUDOLF JULIUS EMMANUEL** (1822-1888), a German physicist, helped establish thermodynamics as a science. In 1850, he stated the second law of thermodynamics: "Heat cannot of itself pass from a colder to a hotter body" (see THERMODYNAMICS). He derived an equation that relates the saturated vapor pressure of a liquid to the temperature. He also developed a theory to explain electrolysis (see ELECTROLYSIS). Clausius was born in Köslin, Germany (now Koszalin, Poland). R. T. ELLICKSON

CLAUSTROPHOBIA. See PHOBIA.

CLAVICHORD, *KLAV uh kawrd*, is a keyboard musical instrument. The soft metallic tone of the clavichord is produced by means of metal pins which strike the strings when the keys are pressed. It was popular from about the 1500's to the 1700's and was an ancestor of the piano. See also HARPSICHORD; PIANO; DULCIMER.

CLAVICLE. See COLLARBONE.

CLAVILUX, *KLA vuh luhks*, is an instrument used to project patterns of light and color in rhythmic order on a screen. The motion and combination of forms are supposed to resemble the phrases and themes of music. Thomas Wilfrid invented the clavilux, also called *color organ*, in 1922. The composer Alexander Scriabin had used a *lightclavier*, a similar instrument, to accompany the music in his *Prometheus, the Poem of Fire* (1909-1910). See also WILFRID, THOMAS. KARL GEIRINGER

CLAW. See ANIMAL (Ways of Life).

CLAY is the kind of earth made up of extremely fine particles. Typical clay feels smooth and a little oily. When wet it becomes a sticky, yet slippery, mud. Dry clay does not hold together well and is easy to turn to powder or dust. The minerals that make up ordinary clay are mostly hydrous silicates of aluminum. A few clays contain little aluminous material or none at all. The purest clay, called kaolin, is white. Most clay is colored by other materials. Iron oxide may color it red; carbonaceous matter may color it different shades of gray; and other materials may give it still other colors. A large amount of calcium carbonate is present in the clay called *marl*, while much silica is present in *fire clay*.

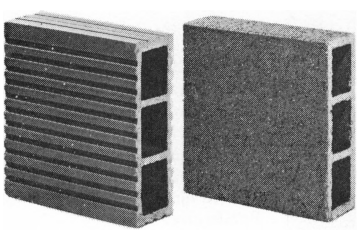
Kinds of Clay. Clays are of two sorts—residual and sedimentary. *Residual clays* result when rocks wear down and crumble in a process called weathering. The best rock for this clay is the kind with considerable aluminous minerals. Residual clay is found in layers if the rock from which it was formed was that way. Clay that comes in *strata* (layers) is called *stratified*. *Sedimentary clays*, the second kind, may originally have been formed the same way as the residual clays. Then the wind or water carried the clay particles to another place.

Uses for Clay. The clay in the soil is important for agriculture. It absorbs ammonia and other gases necessary for the growth of plants. It also holds in the soil the fertilizing substances supplied by manures. Without a certain amount of clay, soil will not keep its fertility from season to season. Too much clay makes the soil stiff and cold, holds too much water on the surface, and hardens it too much in time of drought.

Moist clay can be molded into any form, rolled into thin sheets, or drawn into rods and twisted into ornamental shapes. When clay is heated to the proper temperature, it shrinks and hardens. It no longer turns to mud when wet, or crumbles when exposed to the weather. In this form it finds a great many uses, such as building brick for houses and other durable structures.

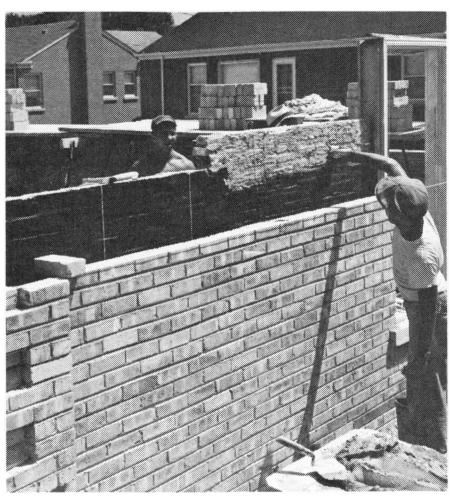
Different clays have different names and uses depend-

SOME USES OF CLAY



Structural Clay Products Institute

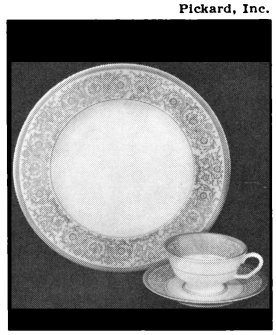
Hollow Clay Tile weighs less than brick. In building construction, it may be used by itself or with brick.



Clay Bricks form attractive building walls. Bricklayers arrange the bricks in designs called *bonds* for strength.

Kaolin Clay is used in fine china porcelain. Called *china clay*, it is pure white. Thin china dishes allow light to shine through without being transparent.

Pickard, Inc.



ing on their composition. Pure *kaolin* is used to make the finest porcelain. *Potter's clay* and *pipe clay* are less pure than kaolin. They are used for inexpensive pottery and pipes. *Fire clay*, which can stand high temperatures, serves for stove and furnace linings, firebrick, gas retorts, and crucibles. *Paper clay* is a fine variety which is used to give paper a smooth shiny surface. A. PABST

Related Articles in WORLD BOOK include:

Adobe	Fuller's Earth	Pottery
Alumina	Kaolin	Silica
Bentonite	Loam	Soil
Brick	Marl	Terra Cotta
Feldspar	Porcelain	Tile

CLAY, CASSIUS. See ALI, MUHAMMAD.

CLAY, CASSIUS MARCELLUS (1810-1903), was an American politician and abolitionist. He was the son of a slaveholder, but he learned to despise slavery and preached against it. In 1845, he founded an antislavery newspaper, *True American*, in Lexington, Ky. After moving to Louisville, he called it the *Examiner*. His views on slavery and his fiery nature earned him a reputation as a rebel and a brawler. He carried two pistols and a knife because of threats on his life, and he guarded his office and his home with a cannon.

Clay was born in Madison County, Kentucky, and studied at Yale. He served in the Kentucky legislature in 1835, 1837, and 1840. He worked for Abraham Lincoln's election in 1860 and was minister to Russia in 1861 and 1862 and from 1863 to 1869. FRANK L. KLEMENT

CLAY, HENRY (1777-1852), was a leading American statesman for nearly 40 years. He repeatedly helped hold the Union together through compromises between the North and the South. Clay became known as the "Great Pacificator." With John C. Calhoun and Daniel Webster, he formed a "great triumvirate" of United States senators. Their opinions largely controlled Congress during the second quarter of the 1800's (see CALHOUN, JOHN C.; WEBSTER, DANIEL). Clay's generous nature, charming manner, ready wit, and moving eloquence made him one of the most idolized figures of his time. His famous remark, "I had rather be right than be President," is often quoted to show his devotion to principle. In 1957, he was elected to the U.S. Senate Hall of Fame. A statue of Clay represents Kentucky in Statuary Hall in the U.S. Capitol.

Early Career. Clay, the son of a Baptist minister, was born on April 12, 1777, in Hanover County, Virginia. He had little education, but had a keen mind and liked to read. He studied law, was admitted to the Virginia bar in 1797, and began to practice in Lexington, Ky. Success came to him almost at once.

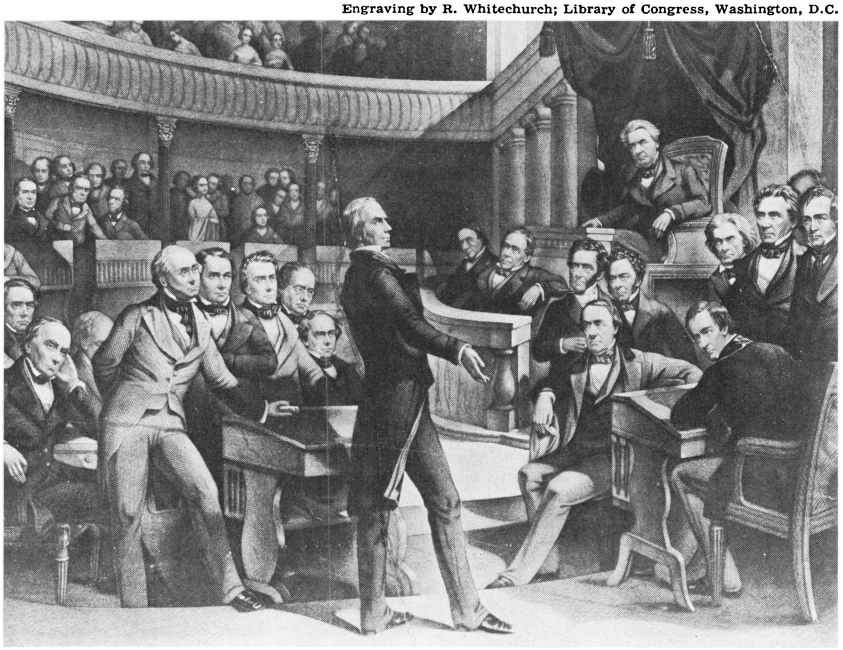
Clay began his long political career in 1801 as a member of the Kentucky constitutional convention. From 1806 to 1807, and from 1809 to 1811, he filled unexpired terms in the U.S. Senate. When first chosen senator, he was not quite 30 years old, the legal age required by the Constitution. But Clay's fellow senators made no official investigation of his age.

Clay entered the U.S. House of Representatives in 1811, and was elected speaker on the first day of the session. He was re-elected to the House and to the speakership five more times. As chief of "the War Hawks," he argued in favor of the War of 1812 so strongly that some people called it "Mr. Clay's War." He was one of the commissioners chosen to make peace, and signed the Treaty of Ghent (see WAR OF 1812).

After the war, Clay advocated a kind of national planning that he called "the American System." It included a protective tariff, a national bank, and government support of internal improvements for better transportation. Clay hoped that these measures would encourage prosperity and tie together the different sections of the country. He became a leader of the National Republican Party, later called the Whig Party.

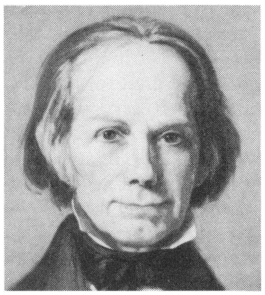
Advocate of Compromise. In 1820, Clay used his influence to get the Missouri Compromise passed

Engraving by R. Whitechurch; Library of Congress, Washington, D.C.



Henry Clay spoke eloquently before the United States Senate in support of the Compromise of 1850, *left*. His ability to bring about compromises between the North and South earned him the title the "Great Pacificator."

(see MISSOURI COMPROMISE). Missouri joined the Union as a slave state and Maine as a free state. In this way, Clay helped to settle a dispute between proslavery and antislavery groups.



Detail of an oil portrait by Allyn Cox; U.S. Capitol, Washington, D.C. (Library of Congress)

Henry Clay

In 1832, South Carolina nullified a tariff law and refused to obey it. The next year, Clay arranged a compromise tariff that ended this threat to peace. Clay also sponsored the Compromise of 1850, which delayed the Civil War for over 10 years (see COMPROMISE OF 1850).

Candidate for President. No man was ever more eager than Clay to be President. He ran for President three times, but never won. In 1824, no candidate had a majority of the electoral votes, and the election was decided by the House of Representatives. Its members voted on the three candidates who had received the most votes. Clay had come out fourth in the election, and so could not be chosen. He gave his support to John Quincy Adams, who was elected. Adams then appointed Clay secretary of state. The two men were accused of a "corrupt bargain" because of this appointment. The charge was not true, but it was used against Clay throughout his career. As secretary of state, Clay worked for friendly relations with Latin America.

In 1832, the Whigs nominated Clay for the presidency. But he had supported high tariffs and the United States Bank, which were unpopular. He lost overwhelmingly to Andrew Jackson. In 1844, Clay ran for President against James K. Polk. Clay refused to take sides on the question of annexing Texas, and lost the votes of both the antislavery men of the North and the slave owners of the South. Again he was defeated.

Life at Ashland. Clay made a good income during the years he practiced law. Ashland, his beautiful country estate at Lexington, was one of the show places of Kentucky. Clay was interested in stock breeding, and became the first to import pedigreed sheep and cattle to the West. He also owned prize winning race horses.

Clay suffered several tragedies in his home life. His oldest son, Theodore, was confined to a mental institution. His six daughters died when they were young, and his son Henry was killed during the Mexican War.

On a placard by Clay's grave at Lexington appears a quotation from one of his speeches: "I know no North—no South—no East—no West." RICHARD N. CURRENT

See also *Clay, Henry*, in the RESEARCH GUIDE/INDEX, Volume 22, for a *Reading and Study Guide*.

CLAY, LUCIUS DUBIGNON (1897-), served as commander in chief of the United States armed forces in Europe and as military governor of the U.S. zone in Germany from 1947 to 1949. In 1948, Russia blockaded all supply routes to the Western section of Berlin. The Russians hoped to drive the forces of the United States, Great Britain, and France out of Berlin. But the Berlin Airlift, directed by Clay, flew food and other supplies into the city (see BERLIN AIRLIFT).

Clay was born in Marietta, Ga., and graduated from the United States Military Academy in 1918. He served as an Army engineer. During World War II, Clay directed the delivery of supplies to invasion fronts. He retired from the Army in 1949, and became associated with several civilian firms. Clay served as an adviser to the Office of Defense Mobilization in 1951. In 1961 and 1962, he served as the personal representative of President John F. Kennedy in Germany. From 1968 to 1974, Clay was chairman of Radio Free Europe (see RADIO FREE EUROPE). He wrote a book, *Decision in Germany* (1950), based on his experiences in military government. MAURICE MATLOFF

CLAY MODELING. See SCULPTURE (The Sculptor at Work).

CLAYMORE. See SWORD.

CLAYTON, JOHN MIDDLETON (1796-1856), an American statesman, served three terms as U.S. senator from Delaware. His greatest achievement was the Clayton-Bulwer Treaty of 1850 (see CLAYTON-BULWER TREATY). He entered the Senate in 1829, but resigned in 1836 to become chief justice of Delaware. From 1845 until his death, he served as senator, except for one year as secretary of state under President Zachary Taylor. Clayton was born in Dagsboro, Del. A statue of him represents Delaware in the Statuary Hall collection in the U.S. Capitol. ARTHUR A. EKIRCH, JR.

CLAYTON ANTITRUST ACT. See TRUST (Trust Legislation); WILSON, WOODROW (Legislative Program).

CLAYTON-BULWER TREATY, signed by the United States and Great Britain in 1850, gave both countries an equal share in the protection of a canal to be built through Central America. Both countries agreed to maintain the neutrality of the canal and the land on either side of it. The treaty was named for John M. Clayton, American secretary of state, and Sir Henry Bulwer (1801-1872), British minister to the United States. This treaty became unpopular in the United States. In 1901, the Hay-Pauncefote Treaty replaced the Clayton-Bulwer Treaty. It granted the U.S. the right to build and manage the canal. JOHN DONALD HICKS

See also CLAYTON, JOHN MIDDLETON; HAY-PAUNCEFOTE TREATY; NICARAGUA CANAL.

CLEANING. See DRY CLEANING; LAUNDRY.

CLEANING FLUID is any liquid used for dry cleaning. These liquids dissolve grease readily and do not damage clothes. They dry quickly, and leave almost no odor. All fluids must meet minimum fire-prevention standards. Chemically, cleaning fluids are organic compounds. Most of them are chlorinated hydrocarbons. Perchloroethylene (C_2Cl_4) is perhaps the most satisfactory. See also DRY CLEANING. W. NORTON JONES, JR.

CLEANLINESS. See BATHS AND BATHING (Modern Attitudes); HEALTH (Cleanliness); SANITATION.

CLEAR LAKE CITY, Tex., lies about 20 miles (32 kilometers) southeast of Houston. It houses workers from the nearby Lyndon B. Johnson Space Center of the National Aeronautics and Space Administration (NASA). The center plays an important role in the U.S. manned space program. Construction of Clear Lake City began in the early 1960's. Developers planned for its completion during the 1980's and for a population of about 150,000. See also LYNDON B. JOHNSON SPACE CENTER; NATIONAL AERONAUTICS AND SPACE ADMINISTRATION; TEXAS (Today). GEORGE W. SCHLESSELMAN

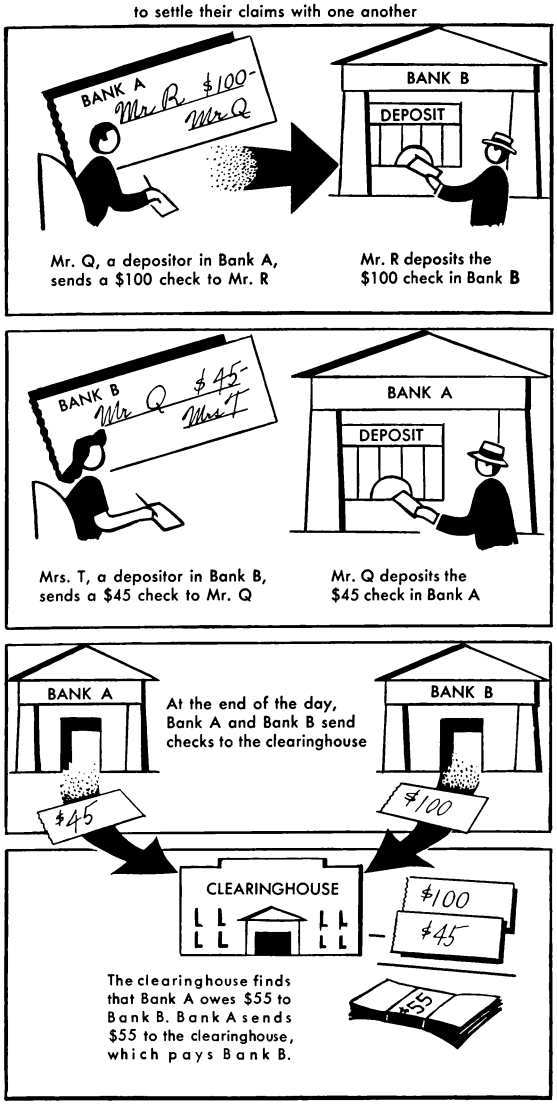
CLEARINGHOUSE

CLEARINGHOUSE is an institution maintained by an association of banks in a city. Its purpose is to settle quickly the claims which each bank has against the others, with the least possible transfer of cash.

The method used in the New York Clearing House served as a model for all later ones in America. This method permits each bank in the city to send at least two representatives to the clearinghouse. They are a *delivery clerk* and a *settling clerk*. Both clerks are assigned to a desk in a large room. When they arrive, they give the manager of the room a list of the amounts due their bank from each of the other banks. The list includes all checks, drafts, and other obligations. At 10 A.M. the delivery clerks begin moving from desk to desk. They deliver to each settling clerk the claims their banks have against his bank. Each settling clerk then draws up a statement which shows the balance his bank should pay or receive from each other bank. The manager checks the statements and reads out the amount each bank owes or is owed. The debtor banks pay the amount due to the clearinghouse manager. In turn, the manager pays the creditor banks. To clear checks, banks use the Federal Reserve Banks, which act as intercity clearinghouses. See FEDERAL RESERVE SYSTEM.

HOW BANKS USE THE CLEARINGHOUSE

to settle their claims with one another



London banks used collectors called *walk clerks* in the 1600's. They would go to each bank and collect cash to cover credits. Two of these walk clerks happened to meet in a coffeehouse about 1670. They decided to save time and effort by arranging their exchange then and there. Other clerks soon learned of this scheme. Before long the coffeehouse had become the first clearinghouse. When the bankers found out, some of them ordered it stopped. But others realized that the idea had merit. They persuaded the rest to join them in engaging a room for the clerks. A set of clearing rules was later made, and a manager was placed in charge of the room. This beginning developed into the London Clearing House, the largest in the world.

New York City established the first American clearinghouse in 1853. Boston, Philadelphia, Pittsburgh, and Chicago founded theirs soon after. Every city of size or commercial importance now has one. G. L. BACH

CLEARWATER DAM is part of a government flood-control project on the Black River near Piedmont, Mo. This earth-fill type dam is 4,225 feet (1,288 meters) long and 154 feet (47 meters) high. It was completed in 1948. Behind the dam is a reservoir that can control floods in an area of about 900 square miles (2,300 square kilometers). T. W. MERMEL

CLEAVAGE. See GEM (Qualities); MINERAL (Cleavage; Chemical Bonds); DIAMOND (What Diamonds Are).

CLEAVELAND, MOSES. See CLEVELAND (Ohio).

CLEAVER, ELDRIDGE (1935-), is a black American author and a spokesman for the doctrine of *Black Power*. According to this doctrine, blacks must organize politically so they can deal with white society from a position of strength.

Cleaver became best known for his book *Soul on Ice* (1968), which he wrote while serving a prison sentence. The book consists of essays and letters that describe the forces that shaped Cleaver's life. It also includes observations by Cleaver on race relations in the United States. Critics have praised the book for its literary merit and for its insights into black attitudes toward American society.

Leroy Eldridge Cleaver was born in Wabbaseka, Ark., and grew up in California. As a youth, he spent several years in reform schools and prisons. In 1958, he was convicted of assault with intent to kill and given a 2- to 14-year prison sentence. Cleaver wrote *Soul on Ice* while serving this sentence. Cleaver received a parole in December, 1966, and soon afterward he joined the Black Panther Party. In April, 1968, he became involved in a shooting incident with police in Oakland, Calif. His parole was revoked, and he was ordered back to prison. Cleaver then fled to Algeria. He moved to Paris in 1973. CHARLES V. HAMILTON

See also BLACK PANTHER PARTY.

CLEF. See MUSIC (Notation).

CLEFT LIP is a *cleft* (split) through the upper lip. This condition is sometimes called *harelip*, because it resembles a hare's split upper lip. Doctors do not know what causes cleft lip. Something prevents this section of the

lip from growing together before the baby is born. Cleft lip may be single; that is, only one side of a lip may be cleft. Or both sides of a lip may be open. *Cleft palate*, an opening in the roof of the mouth, often occurs with cleft lip (see CLEFT PALATE). Sometimes a deformity of the nose also occurs. Doctors can successfully close these openings by means of surgical operations. PAUL W. GREELEY

CLEFT PALATE is a split in the palate, or roof of the mouth. The condition usually causes a speech defect. Cleft palate is *congenital* (present at birth) and results when the bones of the hard palate fail to join properly as the fetus develops. In most cases, doctors can join the two parts of the palate in an operation. See also CLEFT LIP; TONSIL (picture).

CLEISTHENES, *KLYS thuh neez*, was a statesman in ancient Athens. He established a democratic constitution there after Hippias, who held complete political power, was overthrown in 510 B.C. Cleisthenes was a member of the noble Alcmaeonid clan. This clan persuaded Cleomenes, the king of Sparta, to overthrow Hippias. After that, Cleisthenes gained public support by setting up a democratic form of government. He then reformed the Athenian tribal organization, ending the political and religious control of the noble clans. To protect the new democracy, he enacted laws providing for *ostracism* (banishment) for enemies of the state. DONALD KAGAN

See also ATHENS (History).

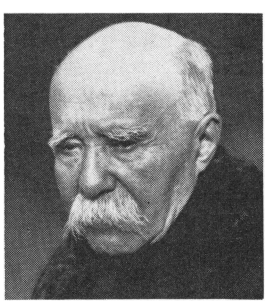
CLEMATIS, *KLEHM uh tihs*, is any one of a group of herblike perennials and vines that grow throughout North America, Europe, and Asia. Several small-flowered kinds are called *virgin's-bower*. The most popular American species include a large group of hybrid vine varieties that may climb 10 feet (3 meters) high and have flowers 6 inches (15 centimeters) across. Clematis blossoms may be deep blue, violet, white, pink, or red. After the flowers fade, long feathery tufts remain on the vine.

Walter Chandoha

Clematis

Scientific Classification. Clematis belongs to the crowfoot family, *Ranunculaceae*. The best-known American vine is genus *Clematis*, species *C. jackmanii*. GEORGE A. BEACH

CLEMENCEAU, *KLAY MAHN SO*, or *KLEM un so*, **GEORGES** (1841-1929), a French statesman, led his country triumphantly through the last and most difficult period of World War I. In 1917, when he was 76, he became premier of France for the second time. He exercised powerful leadership with his slogan, "I make war!" and became known as "The Tiger of France." He presided over the Paris Peace Conference, where he insisted on severe terms for Germany and sought to obtain the left bank of the Rhine River for France. Clemenceau ran for president of France in 1920, but lost to Paul Deschanel. He resigned from his office as premier the day after he was defeated.



Keystone

Georges Clemenceau

Clemenceau was born on Sept. 28, 1841, in Mouilleron-en-Pareds, near La Roche-sur-Yon, France. Trained as a doctor, he traveled and taught for a time in the United States, where he married an American. When he returned to France, he became mayor of Montmartre, a section of Paris. He helped defend Paris against the Germans in 1870. Clemenceau served as a deputy from 1876 to 1893, and as premier from 1906 to 1909. ERNEST JOHN KNAPTON

CLEMENS, SAMUEL LANGHORNE. See TWAIN, MARK.

CLEMENT was the name of 14 popes of the Roman Catholic Church. The fifth and sixth were French, and resided at Avignon. Historically, the most important were Clement I, Clement VII, and Clement VIII. The dates of their reigns were:

Clement I, Saint	(88-97)	Clement VIII	(1592-1605)
Clement II	(1046-1047)	Clement IX	(1667-1669)
Clement III	(1187-1191)	Clement X	(1670-1676)
Clement IV	(1265-1268)	Clement XI	(1700-1721)
Clement V	(1305-1314)	Clement XII	(1730-1740)
Clement VI	(1342-1352)	Clement XIII	(1758-1769)
Clement VII	(1523-1534)	Clement XIV	(1769-1774)

Saint Clement I (? -99?) is commonly known as CLEMENT OF ROME. The third bishop of Rome after Saint Peter, Clement was the first of the early writers called "Apostolic Fathers." His *Epistle to the Corinthians* is an important source of early church history. It describes the organization of the early church and the primacy of the bishop of Rome.

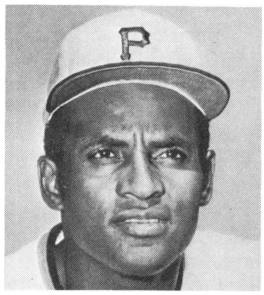
Clement VII (1478-1534) belonged to the Medici family of Florence (see MEDICI). He reigned during the troubled early years of the Reformation. Weak and vacillating, Clement VII was ill-suited to govern the church during such critical times. He refused to grant Henry VIII of England a divorce from his wife, Catherine of Aragon (see HENRY [VIII]). This refusal caused Henry to leave the Roman Catholic Church and found the Anglican Church.

In 1527, troops of the Holy Roman Emperor Charles V sacked Rome, and Clement was held prisoner for a time. Later, he was reconciled with the emperor, and he urged Charles to take strong measures against the Protestants in the Holy Roman Empire. Clement saw the need for reform in the church, but he failed to take vigorous action to accomplish it.

Clement VIII (1536-1605) was elected pope in 1592 at a critical time in church history. France and Spain were at war, and the pope had to avoid driving France into Protestantism and breaking with Spain. Clement reconciled King Henry IV of France with the Roman Catholic Church, and led in the mediations resulting in the Peace of Vervins between France and Spain. A lover of learning and a friend of scholars, Clement published revisions of the Vulgate, the breviary, and other liturgical books. THOMAS P. NEILL and FULTON J. SHEEN

CLEMENTE, ROBERTO (1934-1972), a Puerto Rican athlete, was one of the greatest baseball players in history. He won four National League batting titles

and had a lifetime batting average of .317. Clemente won the league's Most Valuable Player award in 1966. He played on 12 National League All-Star teams during his 18-year career.



Wide World

Roberto Clemente

Clemente, who played right field for the Pittsburgh Pirates, won fame for his fine fielding and throwing as well as his hitting. He helped lead the Pirates to World Series victories in 1960 and 1971. Clemente never went hitless in a World Series game, and he was named the outstanding player of the 1971 series. On Sept. 30, 1972, three months before his death, he became the 11th man in major-league history to get 3,000 hits.

Roberto Walker Clemente was born in Carolina, Puerto Rico. He died in a plane crash off the coast of Puerto Rico while flying to aid earthquake victims in Nicaragua. Clemente was elected to the National Baseball Hall of Fame in 1973. HERMAN WEISKOPF

CLEMENTI, *clay MEN tee,* **MUZIO** (1752-1832), was an Italian pianist and composer. He composed *Gradus ad Parnassum* (1817), a collection of studies which is still used in developing piano technique. In addition, he composed more than 60 piano sonatas. The Irish composer and pianist John Field was among Clementi's many famous pupils. Clementi was born in Rome. He went to England at the age of 14, and remained there most of his life. Clementi was buried in Westminster Abbey. ROBERT U. NELSON

CLEMSON UNIVERSITY. See UNIVERSITIES AND COLLEGES (table).

CLEOPATRA, *KLEE oh PAT ruh,* or *KLEE oh PAY truh,* was the name of several Macedonian queens of Egypt. The most famous Cleopatra lived from 69 to 30 B.C. Some historians believe that she was Cleopatra VII. Others call her Cleopatra VI. But all agree that she was the last of the line of the Ptolemies, who had ruled Egypt for almost 300 years. Although not particularly beautiful, she was intelligent, witty, and ambitious. She attracted some of the greatest Romans of her day.

Cleopatra became queen in 51 B.C. when her father, Ptolemy XI Auletes, died. By the terms of his will, her brother, Ptolemy XII, then about 10 years old, was made joint ruler. In 49 B.C., young Ptolemy's guardians seized the power for him and drove Cleopatra from the throne. When Julius Caesar came to Alexandria in 48 B.C. in pursuit of Pompey, Cleopatra was secretly introduced into the palace, and Caesar fell in love with her. In a brief civil war that followed, her brother was defeated and drowned while trying to escape. A younger brother, Ptolemy XIII, then took the throne with Cleopatra. In 46 B.C., she went to Rome, where she stayed with Caesar until his death in 44 B.C. When she returned to Egypt, she had her brother put to death so that Caesarion, her son by Caesar, could rule with her as Ptolemy XIV.

The British Museum, London

Cleopatra's Portrait appears on a coin made in 30 B.C.

She Meets Mark Antony. In 41 B.C., after the battle of Philippi, Cleopatra met Mark Antony at Tarsus in Asia Minor. She was dressed as Aphrodite, the Greek goddess of love. Antony at once fell in love with her and visited her at Alexandria. He married her in 37 B.C., after he deserted his wife Octavia, sister of Octavian, the future Emperor Augustus. Then Antony and Cleopatra cooperated closely to achieve their ambitions. He wanted to be sole ruler of Rome, and considered the wealth of Egypt a much-needed asset. She at the same time wished to bring Egypt into the empire as a partner rather than as a conquered province. Just as she had hoped to rule the Roman world as Caesar's queen, she now wished to rule as Antony's favorite.

The result of this alliance was a war between Antony and Octavian. Antony lost many of his Roman supporters, because they objected to the ambitions of Cleopatra. In 31 B.C., Antony lost the naval battle of Actium on the west coast of Greece. He and Cleopatra fled to Alexandria. While Octavian pursued them, Cleopatra led Antony to commit suicide by spreading a report that she had taken her own life. She established herself in a mausoleum built for her own burial. She then sent a message to Antony, telling him that when he received the message she would be dead. Before Antony died, he learned that Cleopatra was still living. His followers carried him to Cleopatra, and he died in her arms.

Her Death. Cleopatra then tried unsuccessfully to bring the cold-blooded Octavian under her spell. Rather than be carried off in humiliation to Rome, where Octavian could exhibit her, she killed herself. Tradition says she had an asp brought secretly to her in a basket of figs (see ASP). She placed the asp on her arm and died of its bite. But she may have used a horned viper, which is sometimes known as an asp, or a poisonous drug. Octavian, it is said, ordered that she have a magnificent funeral and that her body be laid next to that of Antony, according to her wishes. After her death, her son Caesarion was executed by the Romans to prevent him from claiming to be Caesar's heir, and the rightful ruler of the Roman Empire.

Cleopatra's reputation in history comes largely from the unscrupulous propaganda by Octavian, which made Antony appear the love-struck victim of an Oriental temptress. The Roman poets Virgil and Horace also adopted this version. Her story has been told many times in literature. It is dramatized in the famous play *Antony and Cleopatra* by William Shakespeare, in *All for Love* by John Dryden, and in *Caesar and Cleopatra* by George Bernard Shaw. CHESTER G. STARR

Related Articles in WORLD BOOK include:

Actium, Battle of	Caesar, Julius	Ptolemy
Antony, Mark	Horace	Virgil
Augustus	Octavia	

CLEOPATRA'S NEEDLES are two famous *obelisks* (stone pillar structures) from ancient Egypt. One of them stands in Central Park in New York City. The other stands on the Thames Embankment in London. The

Egyptian government presented the obelisks to the United States and England during the 1800's.

Cleopatra's Needles are misnamed. They have no connection with the Egyptian queen Cleopatra. The pillars bear the names of two Egyptian kings, Thutmose III, who lived about 1500 B.C.; and Ramses II (1200's B.C.). Cleopatra's Needles originally stood before the Temple of the Sun in Heliopolis. The Romans moved them to Alexandria in 23 B.C.

The obelisk in New York City stands 69 feet (21 meters) high. The structure weighs 200 short tons (180 metric tons). RICARDO A. CAMINOS

See also OBELISK; THUTMOSE III.

CLEPSYDRA. See WATER CLOCK; CLOCK (introduction).

CLERESTORY, *KLIHR STAWR ee,* is a row of windows in the upper story of a building. In a church, the clerestory rises above the roofs of the main aisles and *ambulatory* (an aisle that curves around the room where the altar stands). The clerestory windows of many cathedrals are made of beautiful stained glass.

CLERGYMAN. See MINISTER; PRIEST; RABBI.

CLERICAL WORK. See OFFICE WORK.

CLERK, SIR DUGALD. See DIESEL ENGINE (History).

CLERK OF COURT is an officer of a court of justice who performs many important administrative duties. The clerk keeps on file the court records, such as the *docket* (list of cases awaiting hearing). He issues the *summons* that calls a person into court, and the *judgment* that formally orders the unsuccessful party to do what the court has directed. He also certifies as correct any records of court proceedings that are needed in other legal proceedings. ARTHUR E. SUTHERLAND

CLERMONT was the first commercially successful steamboat. Designed and built by Robert Fulton, it sailed in regular passenger service on the Hudson River. Fulton sailed the wood-burning *Clermont* up the Hudson from New York City to Albany in 1807 on its first trip. The ship was registered as the *North River Steamboat of Clermont,* but it was generally called the *Clermont.* The steamboat was 142 feet (43 meters) long and 14 feet (4.3 meters) wide. An English-built engine drove the *Clermont's* side paddle wheels. The steamboat was dismantled in 1815. For more details and picture, see FULTON, ROBERT. JOHN H. KEMBLE

CLERMONT, COUNCIL OF. See CRUSADES (How the Crusades Began).

CLERMONT-FERRAND, *KLEHR MAWN FEH RAHN* (pop. 148,896; met. area 204,699), lies on a high plain in the Auvergne region of France, about 210 miles (338 kilometers) southeast of Paris. For location, see FRANCE (political map). The city is the center of the French rubber and automobile tire industry. It also is known for its university and for the mineral spring in the vicinity. In 1095 in this city, Pope Urban II preached the sermon that launched the First Crusade. EDWARD W. FOX

CLEVE, PER THEODOR. See HOLMIUM; THULIUM.

Ewing Galloway

Cleopatra's Needle stands in Central Park in New York City. The 69-foot (21-meter) obelisk was brought to the United States from Egypt in 1880. The structure is over 3,000 years old.

Rebman Photographers, Inc.

Cleveland is one of the leading U.S. industrial centers. Many factories border the Cuyahoga River, which winds through the city. The 52-story Terminal Tower rises above downtown Cleveland.

CLEVELAND, the largest city in Ohio, is one of the leading industrial centers of the United States. It lies on the southern shore of Lake Erie, at the mouth of the Cuyahoga River. These waterways and the city's location near huge supplies of coal and iron ore helped make Cleveland an important steel producer. The city also ranks as a transportation and cultural center of the Midwest and a chief Great Lakes port.

Moses Cleaveland, a surveyor for the Connecticut Land Company, founded Cleveland in 1796. This company had bought the site of present-day Cleveland from the state of Connecticut. The site formed most of an area called the Western Reserve, which Connecticut had reserved for settlement. The village was named after Cleaveland, but a newspaper printer misspelled the name in 1831 and it has been known as *Cleveland* ever since.

The City

Cleveland covers 76 square miles (197 square kilometers), or about a sixth of Cuyahoga County. The Cleveland metropolitan area, often called *Greater Cleveland*, covers 1,521 square miles (3,939 square kilometers). It extends over four counties—Cuyahoga, Geauga, Lake, and Medina.

Cleveland Proper. The valley of the Cuyahoga River divides the city into an East Side and a West Side. Iron and steel mills, oil refineries, and other plants operate in the valley, called the *Flats*.

Cleveland's chief public buildings border the Mall, a park that extends from Lake Erie into downtown Cleveland. These buildings include the Cuyahoga County Court House, City Hall, the Public Auditorium and Convention Center, and the Public Library.

Monumental Park, commonly called the Public Square, lies nearby in the center of the downtown area. Moses Cleaveland set aside the 4.4-acre (1.8-hectare)

FACTS IN BRIEF

Population: 750,879. *Metropolitan Area Population*—2,063,729.

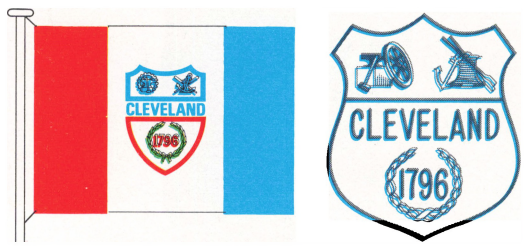
Area: 76 sq. mi. (197 km²), excluding inland water. *Metropolitan Area*—1,521 sq. mi. (3,939 km²), including inland water.

Altitude: 660 feet (201 meters) above sea level.

Climate: *Average Temperature*—January, 27° F. (−3° C); July, 73° F. (23° C). *Average Annual Precipitation* (rainfall, melted snow, and other forms of moisture)—32 inches (81 centimeters). For the monthly weather in Cleveland, see Ohio (Climate).

Government: Mayor-council. *Terms*—2 years for the mayor and the 33 council members.

Founded: 1796. Incorporated as a city in 1836.



Symbols of Cleveland. The city flag's red, white, and blue stripes represent patriotism. The flag, adopted in 1895, has a shield that resembles the city seal, *right*. The seal bears Cleveland's founding date and symbols for its industry and waterways.

square as a park. The Civil War Soldiers and Sailors Monument and a statue of Cleaveland stand in the square. The Terminal Tower Building, one of the tallest buildings in the United States, rises 768 feet (234 meters) at the square's southwest corner.

The city's main streets branch out from the Public Square. Cleveland's best-known street is Euclid Avenue, which extends from the square through the eastern suburbs. The main downtown shopping district lies along Euclid from the square to East 22nd Street.

Cleveland's residential areas spread outward from the downtown district. Like many other industrial cities, Cleveland has large slums. These areas present a sharp contrast to Cleveland's clean and modern suburbs.

Metropolitan Cleveland. Parma, Cleveland's largest suburb, has a population of about 100,000. Other suburbs include Brooklyn, Cleveland Heights, East Cleveland, Euclid, Fairview Park, Garfield Heights, Lakewood, Shaker Heights, and University Heights.

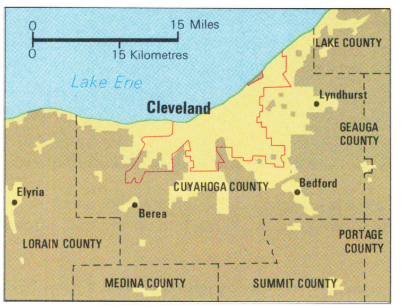
The People

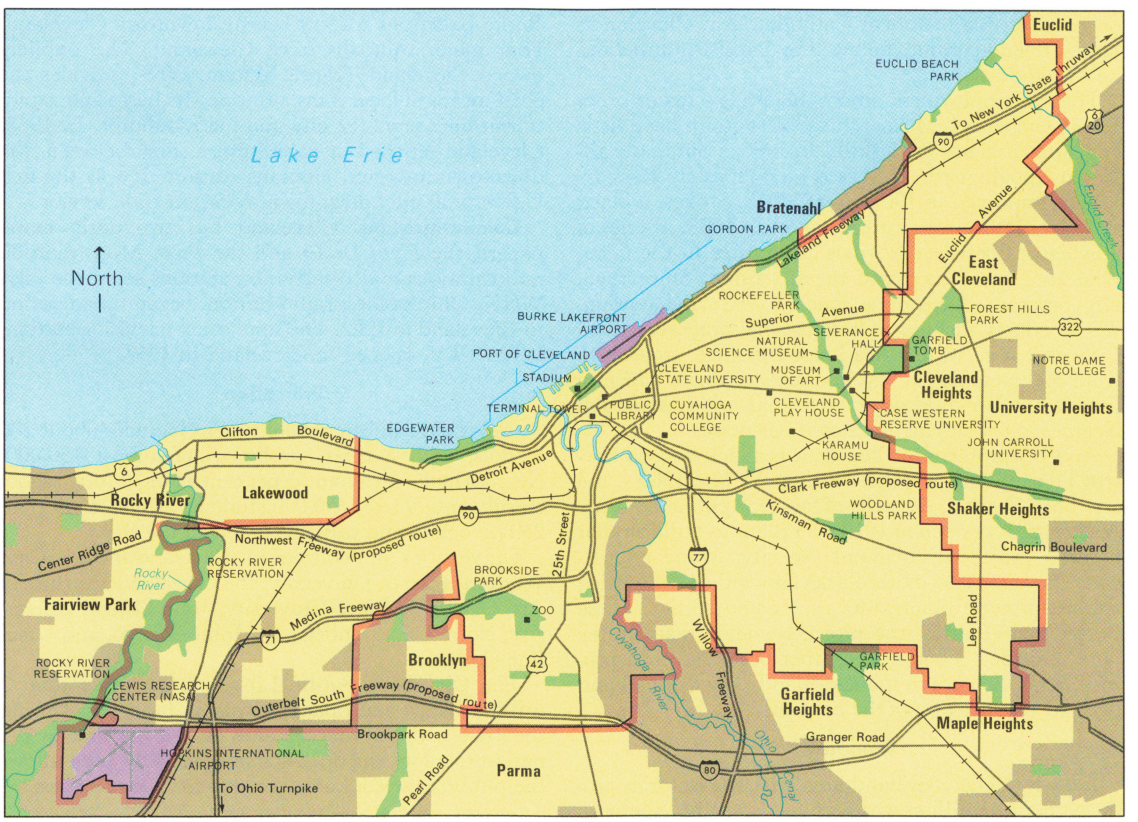
About 90 per cent of Cleveland's people were born in the United States. Negroes make up approximately 40 per cent of the population, and almost all the blacks live on the East Side. Other groups include people of German, Hungarian, Italian, or Slavic ancestry. These

CITY OF CLEVELAND

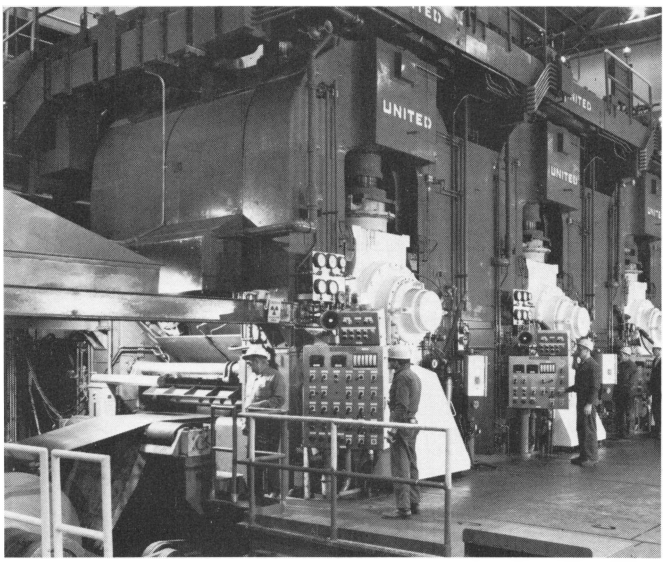
Cleveland lies on Lake Erie in northeastern Ohio. The map at the right shows the metropolitan area of Cleveland. The map below shows the city and its major points of interest. The Cuyahoga River divides Cleveland into two parts.

City boundary
County boundary
Built-up area
Park
Airport
Main road
Other road
Rail line
Point of interest





WORLD BOOK map



Republic Steel Corporation

Steelmaking ranks among the chief manufacturing activities of Cleveland. Machines in a rolling mill, *above*, make steel sheets.

people live on both sides of Cleveland. The city also has about 5,000 American Indians, most of whom live on the East Side. Roman Catholics form Cleveland's largest religious group, followed by Baptists, Lutherans, and Methodists.

High unemployment among blacks is a major problem in Cleveland. Most of this jobless group have little education and few work skills. In 1966, a riot in the all-Negro Hough ghetto increased racial tension. Race relations improved in 1967 after Carl B. Stokes, a black state legislator, was elected mayor. In 1968, a series of gun battles between Negroes and police in the Glenville area again increased racial tension. Since then, city programs have done much to ease the tension. These efforts include a fund-raising program called *Cleveland: Now*, which has helped finance projects to train the unemployed and find jobs for them. The city has also set up child day-care centers and has assisted Negroes in developing their own businesses.

Another problem in Cleveland is a lack of good low-cost housing for the poor. During the late 1960's, the city built about 5,000 units of low-rent public housing. A dispute developed in 1970 over plans to build similar housing projects throughout the city. Many middle-class Clevelanders—both blacks and whites—protested against projects planned for their communities. These people charged that the projects would create traffic jams, crowded schools, and other problems. The protests led to debates in the Cleveland City Council and delayed construction of the housing.

Economy

Industry. The Cleveland area's 10,000 factories produce about $7 billion worth of goods yearly. About 45 per cent of the city's workers are employed in manufacturing. The production of transportation equipment is Cleveland's chief industrial activity and the city ranks high in the manufacture of motor-vehicle bodies and parts. Cleveland is also a chief producer of machine tools. Other goods include clothing, chemicals, electrical equipment, paint, and petroleum products.

Manufacturing has brought prosperity to Cleveland, but the city's many factories have also created problems. During nationwide economic slumps, for example, Cleveland usually has a higher percentage of unemployed workers than do some other major urban centers. In addition, many Cleveland industries pollute the city's air and water. Fumes from the factories often threaten public health, and industrial wastes dumped into Lake Erie have made swimming unsafe at Cleveland's beaches. The Cuyahoga River is so polluted that it has been declared a fire hazard. The river actually caught fire in 1969 because it contained so many burnable fluids from the industries along its banks.

Shipping. Cleveland's harbor, one of the busiest on the Great Lakes, handles about 25 million short tons (23 million metric tons) of cargo annually. It receives more iron ore than any other U.S. port. Between 1940 and 1959, the city spent over $20 million to widen, deepen, and straighten the Cuyahoga River. Today, ore and coal vessels can travel more than 5 miles (8 kilometers) inland to steel mills. The opening of the St. Lawrence Seaway in 1959 made Cleveland an international seaport. Ocean-going ships sail via the seaway from the Atlantic Ocean to the Great Lakes.

Transportation. Cleveland Hopkins International Airport lies in the southwestern section of the city, and Burke Lakefront Airport is near downtown Cleveland. Four major railroads serve Cleveland. The publicly owned Cleveland Transit System (CTS) provides the chief means of local transportation. Its buses and rapid-transit lines serve the city and many suburbs. In 1968, Cleveland opened a rapid-transit line between the downtown area and Hopkins Airport. It was the first U.S. city to offer downtown-to-airport train service.

Communication. Cleveland has two daily newspapers, the *Plain Dealer* and the *Press*. More than 30 radio stations and 6 television stations serve the city. WHK, Ohio's oldest radio station, began broadcasting in Cleveland in 1922. The state's first television station, WEWS-TV, opened in Cleveland in 1947.

Education

Cleveland's public school system includes about 180 schools, with a total enrollment of almost 150,000. Negroes make up about 55 per cent of the public school enrollment. Nearly 150,000 students attend more than 250 parochial and private schools in the city.

Universities and colleges in Cleveland include Case Western Reserve University, the Cleveland Institute of Art, Cleveland State University, John Carroll University, Notre Dame College, St. John College, and Ursuline College.

The Cleveland Public Library owns more than 3 million books and operates over 35 branches. During the 1880's, the library became one of the first in the nation to adopt the open-stacks plan. This plan allows the public to select books directly from the shelves.

Cultural Life

The Arts. The world-famous Cleveland Orchestra performs in Severance Hall. The orchestra also gives

outdoor summer concerts in the Blossom Music Center near Cuyahoga Falls. The Cleveland Play House, a resident professional theater group, gives plays at three theaters—the Brooks, Drury, and Euclid. Karamu House opened in 1915 as an experiment in racial understanding through the arts. Today, its two theaters present integrated casts in dance and drama programs.

Museums. The Cleveland Museum of Art owns one of the nation's finest collections of American, Asian, and European paintings and sculpture. The Cleveland Natural Science Museum features exhibits on the development of life on the earth. It also has a planetarium. The Cleveland Health and Education Center, which opened in 1940, was the nation's first permanent health museum. The Western Reserve Historical Society displays items from the settlement of the Western Reserve.

Recreation

Parks. Cleveland's park system covers about 2,600 acres (1,050 hectares) and includes about 40 parks. The largest park, 273-acre (110-hectare) Rockefeller Park, was given to the city by the industrialist John D. Rockefeller, Sr. It includes the Cleveland Cultural Gardens, a series of gardens that represent the city's nationality groups. The Cleveland Aquarium is in Gordon Park. Brookside Park is the site of the Cleveland Zoo. The Metropolitan Park District, which circles Greater Cleveland, covers about 15,000 acres (6,070 hectares).

Sports. The Cleveland Indians of the American League play baseball in Cleveland Municipal Stadium, which is also the home of the Cleveland Browns of the National Football League. The Cleveland Cavaliers meet their National Basketball Association opponents in the Cleveland Arena. The Cleveland Crusaders of the World Hockey Association also play there.

Government

Cleveland has a mayor-council form of government. The voters elect the mayor and the 33 members of the city council—all to two-year terms. Property taxes are Cleveland's largest single source of income. Other sources include local bond issues and federal grants.

Like most big cities, Cleveland has difficulty raising enough money to pay for increasingly costly city services. In 1967, the city began to tax the incomes of everyone—including suburbanites—who worked in Cleveland. In 1970 and 1971, voters defeated proposals to increase the tax. In 1971, to avoid a financial crisis, the city stopped hiring firemen and policemen, ended winter recreation programs, and reduced the activities of public health centers. It also halted street-lighting improvements and projects to tear down abandoned buildings.

History

Early Settlement. The Chippewa, Erie, and Iroquois Indians lived in the Cleveland region before the first white men arrived. In 1796, Moses Cleaveland, a surveyor, led a group of Connecticut settlers to the site of what became Cleveland. During the early 1800's, settlers from New England came to the area through the Mohawk Valley and along the shore of Lake Erie. Cleveland became the seat of Cuyahoga County in 1810 and was incorporated as a village in 1814.

Industrial Growth. The opening of the Erie Canal in 1825 provided a cheap transportation route for manufactured goods traveling to the Northwest and for raw materials going to the East. The canal helped Cleveland become a commercial center. In 1836, the Ohio legislature granted Cleveland a city charter. The city had a population of about 6,000 at that time.

During the last half of the 1800's, Cleveland changed from a commercial to an industrial center. The first railroad came to the city in 1851 and connected it with Columbus, the state capital. In 1852, the first boatload of iron ore from the Lake Superior region entered Cleveland's harbor. Shipments of iron ore from Minnesota and coal from Pennsylvania helped the city become a major producer of locomotives and other iron products. Between 1850 and 1870, Cleveland's population grew from 17,034 to 145,281. During this period, the city also became the chief refining center for Pennsylvania oil. In 1870, John D. Rockefeller organized the Standard Oil Company in Cleveland.

During the 1880's and 1890's, the city's rapid industrial growth attracted many settlers from other countries. Most of the immigrants came from Hungary, Lithuania, Poland, or Russia. By 1900, 381,768 persons lived in Cleveland.

The 1900's. During Tom L. Johnson's term as mayor, from 1901 to 1909, Cleveland became one of the best-governed U.S. cities. Johnson improved the police department and brought about lower streetcar fares. He also developed a system of taxing owners of commercial property at a higher rate than homeowners.

The development of the automobile industry during the early 1900's greatly aided steel manufacturing in Cleveland. After the United States entered World War I in 1917, the city produced airplanes, ships, and tanks for the Allies. The rapid expansion of the steel industry after the war helped Cleveland's population reach 900,429 by 1930.

During World War II (1939-1945), the city again produced war materials. Thousands of people from other parts of the United States, including great numbers of Negroes from the South, came to Cleveland seeking work in the defense industries. Most of the newcomers remained in the city after the war. By 1950, Cleveland's population had risen to 914,808.

Recent Developments. A trend toward suburban living developed during the 1950's, and thousands of white middle-class Clevelanders moved to newly built areas outside the city. Cleveland's population fell to 876,050 by 1960 and continued to drop in the 1960's.

The city faced serious racial problems during the 1960's. In July, 1966, 4 persons were killed and 50 were injured during a five-day riot in the Hough area. Racial tension decreased in 1967 after Cleveland voters elected Carl B. Stokes mayor. Stokes, a Democrat, was the first black mayor of a major U.S. city. He won re-election in 1969. Another riot occurred in the Glenville area in July, 1968. It resulted in 11 deaths and property damage of about $2 million.

In 1969, Cleveland announced plans for construction of a $50-million commercial, recreational, and residential complex on the lakefront. This project, called Great Lakes Gateway, was scheduled for completion by the late 1970's.

RUSSELL W. KANE

See also STOKES, CARL B; WESTERN RESERVE.

GROVER CLEVELAND

Oil painting by an unknown artist; New-York Historical Society, New York City

The United States Flag had 38 stars when Cleveland first took office in 1885, and 44 stars when he began his second term in 1893.

GARFIELD
20th President
1881

ARTHUR
21st President
1881 — 1885

B. HARRISON
23rd President
1889 — 1893

McKINLEY
25th President
1897 — 1901

22ND PRESIDENT OF THE UNITED STATES 1885-1889

24TH PRESIDENT OF THE UNITED STATES 1893-1897

CLEVELAND, GROVER (1837-1908), was the only President who served two terms that did not directly follow each other. He won the presidency in 1884, but lost it four years later to Benjamin Harrison. He ran against Harrison again in 1892 and won a second term.

Cleveland was the first Democratic President elected after the Civil War. This very fact showed that the emotions of the war had cooled enough to permit the return to a two-party system. Cleveland's victory also was a protest against the waste and corruption that had disgraced Republican administrations after the war. His honesty and common sense helped restore confidence in the government. These qualities had served him in his earlier successes as a lawyer, sheriff, and mayor, and as governor of New York.

As President, Cleveland had the courage to say "No." He said it often—to farmers who sought easy money to pay their debts, to manufacturers who wanted high protective tariffs, and to veterans who wanted bigger pensions. These "No's" made Cleveland unpopular in his time, but have added to the respect with which history holds him.

This big, good-humored man, called "Uncle Jumbo" by his relatives, occupied the White House during a time of swift social and economic change. The growing strength of labor unions and farm organizations created new problems for government. Cleveland lacked the experience and vision to find completely satisfactory answers to all the problems. He attempted to settle labor strikes by force—the legal force of court injunctions and the physical force of army troops. He clung steadfastly to his faith in "sound" money and a low tariff as a cure for the nation's other economic ills. Although Cleveland's intentions were good, his methods fell short of success.

The era of the western frontier was drawing to a close when Cleveland took office. Settlers in the Southwest breathed easier when federal troops captured Geronimo, the fierce Apache chief. Jacob Riis shocked a complacent public with newspaper stories of how "the other half" lived in run-down slums.

During Cleveland's second term, the Duryea brothers built America's first automobile. A Kansas preacher, Charles Sheldon, wrote *In His Steps*, one of the world's all-time best sellers. Americans of the Gay Nineties enjoyed Victor Herbert's early operettas. At the World's Columbian Exposition in Chicago, they applauded John Philip Sousa's band and rode the first and largest Ferris wheel ever built.

Early Life

Boyhood. Stephen Grover Cleveland was born on March 18, 1837, in Caldwell, N.J. He dropped his first name while still a boy. Grover was the fifth child in a family of four brothers and five sisters. His father, Richard Falley Cleveland, was a Presbyterian minister and a relative of Moses Cleaveland, the founder of Cleveland, Ohio. His mother, Ann Neal Cleveland, was the daughter of a publisher.

The family of a country minister led a hard life. The

IMPORTANT DATES IN CLEVELAND'S LIFE

1837 (March 18) Born in Caldwell, N.J.
1881 Elected mayor of Buffalo, N.Y.
1882 Elected governor of New York.
1884 Elected President of the United States.
1886 (June 2) Married Frances Folsom.
1888 Defeated for re-election by Benjamin Harrison.
1892 Elected to second term as President.
1908 (June 24) Died in Princeton, N.J.

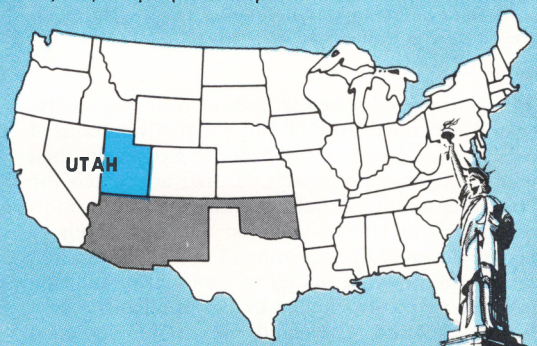
Clevelands had little money and moved several times. Grover attended schools in Fayetteville and Clinton, N.Y., and went to work at the age of 14 as a clerk in a Fayetteville general store. He was only 16 when his father died, leaving him and his brothers to support his mother and sisters. Cleveland joined an older brother who was teaching at the New York Institution for the Blind in New York City. He taught there for a year.

Lawyer. When Cleveland was 17, he decided to go west to look for better opportunities. He planned to settle in Cleveland, Ohio, which attracted him because of its name. But he stopped in Buffalo, N.Y., to visit his mother's uncle, Lewis F. Allen, who persuaded him to stay there. Grover worked for his uncle for six months, then decided to become a lawyer. He worked as a clerk in the law office of Rogers, Bowen, and Rogers, and studied there. The serious, quiet youth worked hard for his $4 a week, which paid for room and board at the home of a fellow law clerk.

After being admitted to the bar in 1859, Cleveland continued to work for the same law firm. Two of his brothers served in the Union Army during the Civil War, but Cleveland's help was needed to support his mother and the other children. He paid a substitute to take his place in the army. Although this was legal

THE WORLD OF PRESIDENT CLEVELAND

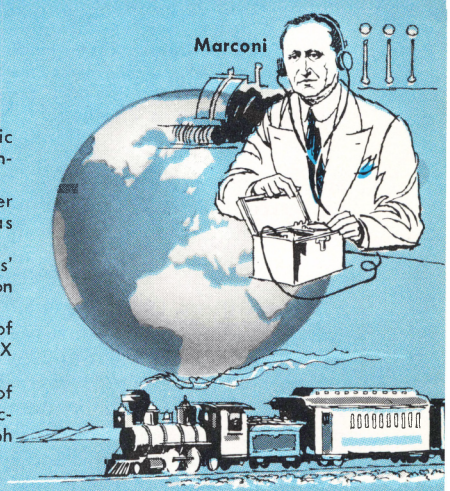
U.S. population was 61,800,000 in 1889, when Cleveland's first term ended. When his second term ended in 1897, the country had 72,200,000 people. Utah joined the Union as the 45th state in 1896.



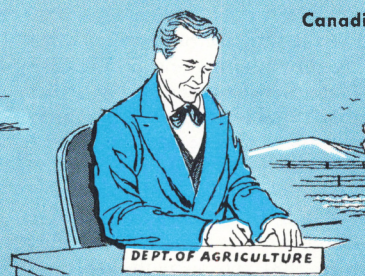
Statue of Liberty, a gift of France to the United States, was dedicated by President Cleveland on Oct. 28, 1886, in New York.

WORLD EVENTS

1885 The Canadian Pacific Railway spanned Canada.
1887 Victoria celebrated her Golden Jubilee as Queen of England.
1894 Captain Alfred Dreyfus' first trial for treason was held in France.
1895 Wilhelm Roentgen of Germany discovered X rays.
1895 Guglielmo Marconi of Italy produced a practical wireless telegraph system.



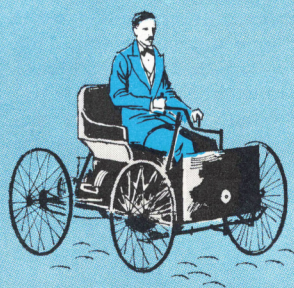
Canadian Pacific Railway



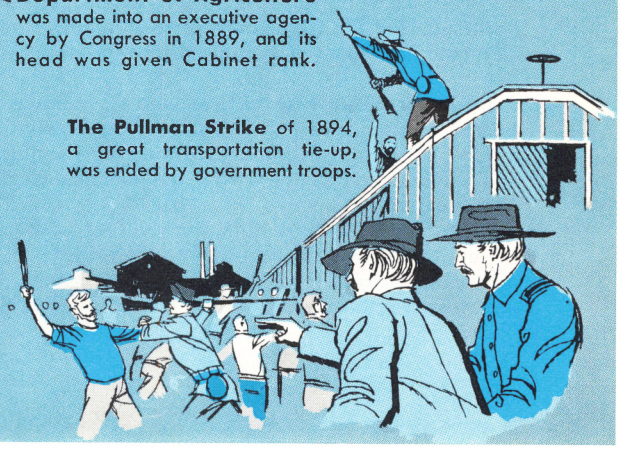
Department of Agriculture was made into an executive agency by Congress in 1889, and its head was given Cabinet rank.

Interstate Commerce Act of 1887 was the first federal law to regulate railroads and other forms of transportation.

The Pullman Strike of 1894, a great transportation tie-up, was ended by government troops.



Henry Ford's First Car appeared on the streets of Detroit, Mich., in 1896. Three years earlier, the Duryea brothers had built the first successful gasoline-powered auto in the United States.



New Jersey Dept. of Conservation and Economic Development

Cleveland's Birthplace was the manse of the First Presbyterian Church of Caldwell, N.J. Cleveland, the minister's son, was born in the rear room on the first floor. The white clapboard house has been preserved as a museum.

Library of Congress

Youngest First Lady in the nation's history was Frances Folsom Cleveland. She married the President in the Blue Room of the White House when she was 21 years old and he was 49. Cleveland called his wife by her nickname, "Frank."

and a common practice, the fact that Cleveland had not served in the war was later used against him by his political enemies.

Political Career

Minor Offices. Cleveland entered politics as a ward worker for the Democratic party in Buffalo. He served as ward supervisor in 1862 and later as assistant district attorney of Erie County. He was elected sheriff in 1870. During his term, the county had to hang two convicted murderers. Most sheriffs had delegated this distasteful task to deputies, but Cleveland sprang the traps himself. He explained that he would not ask anyone else to do what he was unwilling to do.

Cleveland returned to the practice of law after three years as sheriff. He relaxed by hunting and fishing with fellow lawyers. To relatives who wondered whether their stout "Uncle Jumbo" had ever thought of marrying, he replied: "A good many times; and the more I think of it the more I think I'll not do it."

Mayor of Buffalo. Like many cities, Buffalo suffered from a corrupt administration. In response to a growing demand for reform, Democratic leaders chose Cleveland to run for mayor in 1881. He won the election, and gave his political backers more reform than they had bargained for. Cleveland vetoed so many padded city contracts that he became known as the "veto mayor."

Governor of New York. Cleveland's reputation for honest administration became a valuable political asset. The Democrats nominated him for governor in 1882 as a candidate not owned by any political faction. He won easily.

Cleveland gave New York the same conscientious administration he had given Buffalo. He vetoed padded appropriation bills regardless of political pressure. He aroused a storm of protest when he killed a bill that would have lowered streetcar fares in New York City. Cleveland explained that the bill violated the terms of a previous transit contract. Theodore Roosevelt, then a member of the state legislature, had advocated the bill, but later admitted that Cleveland had been right. When Cleveland later cooperated with Roosevelt to pass laws reforming the government of New York City, he earned the undying hatred of Tammany Hall, the Democratic political machine that controlled the city.

Election of 1884. Cleveland's reputation for good government made him a national figure. The Republican party nominated James G. Blaine for President in 1884, even though he had been implicated in a financial scandal (see BLAINE, JAMES G.). Many influential Republicans were outraged. They thought the time had come for a national reform administration. These Republicans, called *mugwumps*, withdrew from the convention and declared that they would vote for the Democratic candidate if he were an honest man (see MUGWUMP). The Democrats answered by nominating Cleveland. They chose Governor Thomas A. Hendricks of Indiana for Vice-President.

Good political issues were available to both parties in the campaign of 1884. Farmers were growing poorer, private interests were grabbing public lands and resources, and labor was becoming more dissatisfied. But neither party faced these issues. Instead, each attacked the other's nominee with scandalous personal stories.

The basic unrest of the people, their lack of faith in the honesty of previous administrations, and a series of campaign blunders by Blaine turned the tide. One of the most costly mistakes was made by a supporter of Blaine at a Republican rally in New York City. Samuel D. Burchard, a Presbyterian clergyman, declared that a vote for Cleveland would be a vote for "rum, Romanism, and rebellion." This remark appealed to popular prejudices that linked the Demo-

CLEVELAND'S FIRST ELECTION

Place of Nominating Convention	Chicago
Ballot on Which Nominated	2nd
Republican Opponent	James G. Blaine
Electoral Vote	219 (Cleveland) to 182 (Blaine)
Popular Vote	4,874,986 (Cleveland) to 4,851,981 (Blaine)
Age at Inauguration	47

crats with whiskey, Roman Catholicism, and the Southern cause in the Civil War. Roman Catholics deeply resented the statement. Blaine later repudiated it, but the damage had been done. Cleveland, by a slim majority of 23,005 votes, became the first Democratic President to be elected since James Buchanan in 1856.

First Administration (1885-1889)

Cleveland, who faced a Republican Senate, made effective use of the presidential powers of veto, appointment, and administrative control. With these weapons, rather than with any strong legislative program, he moved to restore government efficiency.

Reforms. Cleveland ordered the members of his Cabinet to eliminate "abuses and extravagances" in their departments. As a result, the Department of the Navy tightened its supervision of shipbuilding and added several new vessels to the fleet, including the battleship *Maine*. The Department of the Interior forced western railroads to return to the public domain vast acreages of excess right-of-way land that they had held illegally. This land was forfeited because the railroads had failed to carry out their earlier agreements to extend their lines. The forfeited land equaled the combined areas of New York, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia.

The spoils system had continued to flourish in spite of the Civil Service Act of 1883 (see SPOILS SYSTEM). Cleveland, like other Presidents of his era, was besieged by office seekers. He tried to steer a middle course between the reformers, who wanted him to extend civil service, and party politicians, who were hungry for jobs. He more than doubled the number of workers who held jobs through the merit system, although the total still included fewer than a fourth of all government employees. But his moderation satisfied neither the reformers nor the politicians.

Labor Problems were among Cleveland's gravest concerns. Farmers had heavy debts, and the Grange and Farmers' Alliances demanded reforms. Laborers suffered from low wages and harsh working conditions.

VICE-PRESIDENT AND CABINET

Vice-President	*Thomas A. Hendricks
Secretary of State	*Thomas F. Bayard
Secretary of the Treasury	Daniel Manning Charles S. Fairchild (1887)
Secretary of War	William C. Endicott
Attorney General	*Augustus H. Garland
Postmaster General	William F. Vilas Don M. Dickinson (1888)
Secretary of the Navy	William C. Whitney
Secretary of the Interior	*Lucius Q. C. Lamar William F. Vilas (1888)
Secretary of Agriculture	Norman J. Colman (office established in 1889)

*Has a separate biography in WORLD BOOK.

Employers in those days felt little sense of responsibility for their employees. The Knights of Labor, a labor group, grew to 700,000 members by 1886. Its strike at the McCormick-Harvester plant in Chicago led indirectly to the bloody Haymarket Riot (see HAYMARKET RIOT). Cleveland distrusted workers' movements, but he acted for the best interests of the nation as he saw them. He was the first President to devote an entire congressional message to the subject of labor, although nothing came of his proposal for a permanent government arbitration board.

Veterans' Affairs. Cleveland opposed many pension measures, defying the Grand Army of the Republic and other powerful pressure groups. The pension rolls had become full of fraud. Many healthy veterans claimed to be unfit for work, and widows continued to collect government money after they had remarried. Cleveland vetoed hundreds of dishonest claims. He also vetoed the Dependent Pension Bill, which would have extended pension coverage to all disabled veterans, whether or not their disabilities were connected with military service. This bill was later passed in 1890.

The Currency and the Tariff were the most important issues facing Cleveland during his first term. Dissension was growing between the bankers and industrialists of the East, and the farmers of the South and West. The industrialists wanted a high tariff to protect high prices. They also wanted what they called a "sound" money system, based on gold. Farmers wanted a low tariff so they would not have to pay high prices for imported manufactured goods. They had heavy debts, and wanted money to be "cheap" in comparison with goods. That is, the farmers wanted *inflation*, so they could pay their debts with less farm produce.

The Currency of the United States at this time was based on gold. But limited amounts of silver could be sold at the Treasury for gold at the fixed proportion of 16 to 1, or 16 ounces of silver for 1 ounce of gold. The Bland-Allison Act of 1878 required the Treasury to purchase and coin a minimum of $2,000,000 worth of silver a month. Meanwhile, new silver mines had been discovered, and the world price of silver fell. People could buy silver on the open market and make a profit by selling it to the government for gold. As a result, gold was rapidly drained from the Treasury.

Cleveland believed in a gold standard (see GOLD STANDARD). He asked Congress to repeal the Bland-Allison Act, but it refused. The government then issued bonds and sold them to banks for gold. But this helped matters for only a short time, because the drain on the Treasury's gold continued.

The Tariff. Cleveland felt that tariffs should be reduced, mainly because the government was collecting more money than it spent. His supporters advised him not to bring up this controversial subject. But, in his annual message in 1887, he dared to ask Congress to lower tariffs. Congress refused, but Cleveland focused national opinion on this problem.

Other Actions. The Presidential Succession Act of 1886 settled questions regarding succession to the presidency (see PRESIDENTIAL SUCCESSION). One of the most important bills of Cleveland's first term was the Interstate Commerce Act of 1887. This act allowed

the federal government to regulate interstate railroads.

Cleveland's Family. In June, 1886, Cleveland delighted the nation with his marriage to Frances Folsom (July 21, 1864-Oct. 29, 1947). The 21-year-old bride had been Cleveland's ward since her father died in 1875. He had been one of Cleveland's law partners. Cleveland was the only President to be married in the White House, and reporters pried into every detail with what he called "colossal impertinence."

The Clevelands had five children: Ruth (1891-1904), Esther (1893-), Marion (1895-), Richard F. (1897-1974), and Francis (1903-). Esther Cleveland was the first and only child of a President to be born in the White House.

Five years after Cleveland's death, Mrs. Cleveland married Thomas J. Preston, Jr., a Princeton professor.

Life in the White House. During Cleveland's first year in office, his younger sister Rose acted as his hostess. After his marriage, his young wife performed these official duties with ease and charm.

Cleveland was a hard-working President, particularly because he was unwilling to delegate responsibility. "He would rather do something badly for himself than have somebody else do it well," grumbled a political colleague. The President often stayed up until 2 or 3 A.M. going over official business, and sometimes answered the White House telephone himself.

As the Clevelands left the White House in 1889, Mrs. Cleveland told the servants: "I want you to take good care of all the furniture and ornaments in the house, for I want to find everything just as it is now when we come back again . . . four years from today."

Election of 1888. The tariff became the main issue in the election of 1888. Benjamin Harrison, the Republican candidate, opposed tariff reduction. Neither Cleveland nor the Democratic party waged a strong campaign. Cleveland's attitude toward the spoils system had antagonized party politicians. His policies on pensions, the currency, and tariff reform had made enemies among veterans, farmers, and industrialists. Even so, he had more popular votes than Harrison. But Harrison received a larger electoral vote and won the election. See HARRISON, BENJAMIN (Election of 1888).

Between Terms

New York Attorney. Cleveland moved to New York City in 1889 and returned to the practice of law. The Harrison administration reversed many of Cleveland's stringent policies. It boosted the tariff, increased the purchase of silver, and extended pension coverage. Both prices and government expenditures reached new heights. Cleveland, on the sidelines, sharply criticized Harrison's program.

Election of 1892. By the end of Harrison's term, many Americans were ready to return to Cleveland's harder policies. In 1892, the Democratic national convention nominated Cleveland and chose Adlai E. Stevenson, a former Illinois Congressman, as his running mate. The Republicans renominated Harrison and nominated Whitelaw Reid for Vice-President.

The campaign centered mainly on the issue of a sound currency. The new Populist party, formed by groups from the Grange, the Farmers' Alliances, and the Knights of Labor, polled more than a million votes. But Cleveland won easily.

CLEVELAND'S SECOND ELECTION

Place of Nominating Convention	Chicago
Ballot on Which Nominated	1st
Republican Opponent	Benjamin Harrison
Electoral Vote	277 (Cleveland) to 145 (Harrison)
Popular Vote	5,556,918 (Cleveland) to 5,176,108 (Harrison)
Age at Inauguration	55

Second Administration (1893-1897)

Cleveland enjoyed greater popularity at the beginning of his second term than at any other time during his presidency. He had made no promises to anyone in order to become President again. He was free to handle the country's problems as he saw fit, with Democratic majorities in both houses of Congress. But a severe financial panic swept the country only two months after he took office. Its causes included a farm depression, a business slump abroad, and the drain on the Treasury's gold reserve.

At this crucial time, physicians found that Cleveland had cancer of the mouth. Government leaders feared that the nation's shaky financial situation would become worse if the public knew of the President's illness. To keep it a secret, Cleveland boarded a friend's yacht in New York Harbor in July, and a team of surgeons removed his left upper jaw while the ship steamed up the East River. The operation was completely successful. Cleveland wore an artificial jaw made of rubber, which changed his appearance only slightly. News of the operation gradually became public, although great efforts were made to keep it secret.

Labor Unrest grew more serious with the business slump. Cleveland was not hostile to labor. But his strong belief in order and his limited understanding of changing conditions led him to use force rather than to seek constructive solutions to the new problems that faced his administration.

One sign of discontent was "Coxey's Army," a group of unemployed men who demonstrated for government aid (see COXEY, JACOB S.). The Pullman strike of May, 1894, had far greater importance. Workers of the Pullman Company went on strike, and members of the American Railway Union, led by Eugene V. Debs, supported them by refusing to handle Pullman cars (see DEBS, EUGENE V.). A general railroad strike resulted. A federal court issued an injunction against the strikers

VICE-PRESIDENT AND CABINET

Vice-President	*Adlai E. Stevenson
Secretary of State	Walter Q. Gresham *Richard Olney (1895)
Secretary of the Treasury	John G. Carlisle
Secretary of War	Daniel S. Lamont
Attorney General	*Richard Olney Judson Harmon (1895)
Postmaster General	Wilson S. Bissell William L. Wilson (1895)
Secretary of the Navy	Hilary A. Herbert
Secretary of the Interior	Hoke Smith David R. Francis (1896)
Secretary of Agriculture	*Julius Sterling Morton

*Has a separate biography in WORLD BOOK.

because mail service had been interrupted. Disorders broke out near Chicago, and Cleveland sent federal troops, saying: "If it takes the entire army and navy of the United States to deliver a postal card in Chicago, that card will be delivered." The government broke the strike. Most people approved Cleveland's action. But Governor John P. Altgeld of Illinois, who had state militia standing ready, argued that the disorders were not serious enough to warrant federal troops. Some historians believe that Cleveland exceeded his constitutional powers and violated states' rights. See PULLMAN STRIKE.

Tariff Defeat. Cleveland resumed his campaign for tariff reform, and again asked Congress to lower import duties. While the Wilson-Gorman Bill was being debated, the President issued a statement accusing uncooperative Democrats of "party perfidy and party dishonor." His comments outraged many party members, and the bill as passed in 1894 fell far short of Cleveland's goal. He let it become law without his signature because it also provided for a federal income tax. The Supreme Court later declared the income tax provision unconstitutional.

Foreign Affairs. Many Americans in the 1890's felt that the United States should build a colonial empire. Cleveland wanted the United States to respect the rights of smaller, weaker nations. Events in Hawaii and Venezuela tested his principles.

Hawaii. At the end of Benjamin Harrison's administration, American settlers in Hawaii had brought about a revolution and asked the United States to annex the islands. Cleveland's second term began before the Senate could ratify the treaty of annexation. Cleveland felt that Americans in Hawaii had involved the United States in a dishonorable action, and he withdrew the treaty from the Senate. The islands continued independent until 1898.

Venezuela. Cleveland's most popular action during his second term was his firm stand in a boundary dispute between Great Britain and Venezuela. Britain had refused for several years to allow its claim to be decided by a board of arbitration. In 1895, Secretary of State Richard Olney sent a sharp note to Britain declaring that "the United States is practically sovereign on this continent, and its fiat is law upon the subjects to which it confines its interposition." In a message to Congress, Cleveland hinted that armed force might be necessary to settle the matter. England agreed to submit the Venezuela boundary to international arbitration, and a settlement was reached in 1899. But historians have criticized Cleveland's intervention as extreme and provocative.

Saving the Gold Standard. A severe financial panic in 1893 caused 15,000 business failures and threw 4,000,000 persons out of work. Cleveland felt that a basic cause of the panic was the Sherman Silver Purchase Act of Harrison's administration. In June, 1893, he called a special session of Congress to repeal the act. Congress did so, but the nation's gold reserves had dwindled alarmingly. The government floated four bond issues in the next three years to replenish them. J. P. Morgan and other financiers bought three of these bond issues, and Cleveland's opponents charged that he had betrayed the nation to Eastern bankers.

Meanwhile, the silver interests grew stronger. By the time of the Democratic convention in 1896, the "silverites" outnumbered the "goldbugs." To the dismay of Cleveland, who did not seek a third term, William Jennings Bryan won the Democratic presidential nomination. Bryan's famous "cross of gold" speech swung the party to the silver cause (see BRYAN, WILLIAM JENNINGS). Cleveland preferred the sound money policies of William McKinley, the Republican candidate, but he took no part in the campaign. His popularity had reached a low ebb at the end of his term, and he spoke of his "poor old battered name" when he left the White House in 1897.

Later Years

Cleveland spent his last years in Princeton, N.J. Public opinion about him gradually changed, and he regained respect. Cleveland served Princeton University as lecturer and as trustee, and enjoyed the company of Woodrow Wilson, president of the university. He wrote several magazine articles, and in 1904 published some of his lectures under the title *Presidential Problems*. He also helped reorganize the Equitable Life Assurance Society after financial scandals had damaged its reputation. People believed so strongly in him that his name restored their confidence.

After a three-month illness, Cleveland died on June 24, 1908. His last words were: "I have tried so hard to do right." He was buried in Princeton. OSCAR HANDLIN

Related Articles in WORLD BOOK include:
Harrison, Benjamin
Haymarket Riot
Hendricks, Thomas A.
President of the United States
Stevenson, Adlai E. (1835-1914)
World's Columbian Exposition

Outline

I. Early Life
A. Boyhood
B. Lawyer
II. Political Career
A. Minor Offices
B. Mayor of Buffalo
C. Governor of New York
D. Election of 1884
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A. Reforms
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B. Election of 1892
V. Second Administration (1893-1897)
A. Labor Unrest
B. Tariff Defeat
C. Foreign Affairs
D. Saving the Gold Standard
VI. Later Years

Questions

How was Cleveland's marriage unique?

Why did Cleveland pay a substitute to serve for him in the Civil War?

Why did Cleveland execute two criminals himself?

How many Presidents have been defeated for re-election and later won a second term?

Who were the *mugwumps?* How did they affect Cleveland's nomination in 1884?

Historians have criticized two actions of Cleveland's second term which were popular at the time. Why?

Why was Cleveland's jaw operation kept secret?

What actions made him an unpopular President?

How did Cleveland feel about labor agitation? What did he do about it during his first term?

What words, spoken as he died, summed up his life?

CLEVELAND INSTITUTE OF ART

CLEVELAND INSTITUTE OF ART, in Cleveland, Ohio, was established in 1882. It offers four-year professional courses in advertising, ceramics, graphics, illustration, industrial design, painting, portraiture, sculpture, silversmithing, textile design, and weaving. The Cleveland Institute of Art also offers a five-year program leading to a bachelor of fine arts degree, and a five-year art education program in cooperation with Case Western Reserve University. JOSEPH MCCULLOUGH

CLEVELAND STATE UNIVERSITY. See UNIVERSITIES AND COLLEGES (table).

CLIBURN, VAN (1934-), is an American pianist. He gained world fame in 1958 by winning the International Tchaikovsky Competition in Moscow against pianists from 19 countries. When he returned to New York City, he received the first ticker-tape parade ever given a musician. Harvey Lavan Cliburn was born in Shreveport, La., but later moved to Kilgore, Tex. When he was 3, he began to study piano with his mother, a former concert pianist. Cliburn later attended the well-known Juilliard School of Music in New York City. ROBERT U. NELSON

See also PIANO (picture).

CLICK BEETLE is the name used for any one of a group of beetles that spring and snap. There are about 300 different kinds of click beetles in the United States and Canada. Most of them are brown, but some are black, gray, or marked with bright colors.

The young of the click beetle are long, slender worms called *wireworms*. Wireworms bore into seeds of young corn, wheat, and other grains. They also feed on the roots of field and garden plants. See WIREWORM.

Some tropical click beetles can glow in the dark. One kind has two glowing spots on each side of its body. Dead tropical click beetles are sometimes worn as ornaments in Cuba. See BEETLE (Kinds of Beetles).

Scientific Classification. Click beetles are members of the order *Coleoptera*. They make up the click beetle family, *Elateridae*. H. H. ROSS

CLIFF is a steep face of rock. Several processes of erosion form cliffs. Waves cut imposing and scenic cliffs along coast lines. Rivers create deep canyons with steep sides. Glaciers grind away the rock along valley walls and produce cliffs that appear after the glacier melts. Glaciers also pluck rock fragments away from high mountain slopes where snow collects to form walls around amphitheater-like basins. A. J. EARDLEY

CLIFF DWELLERS were Indians who built their homes in the high cliffs of the Southwestern United States. Most cliff dwellings were built between A.D. 1000 and 1300. The dry climate and protected locations have preserved many of them.

Archaeologists have found bows and arrows, cotton and leather garments, food, sandals, wooden implements, and even the mummies of Cliff Dwellers. These discoveries have told much about the life of the Cliff Dwellers.

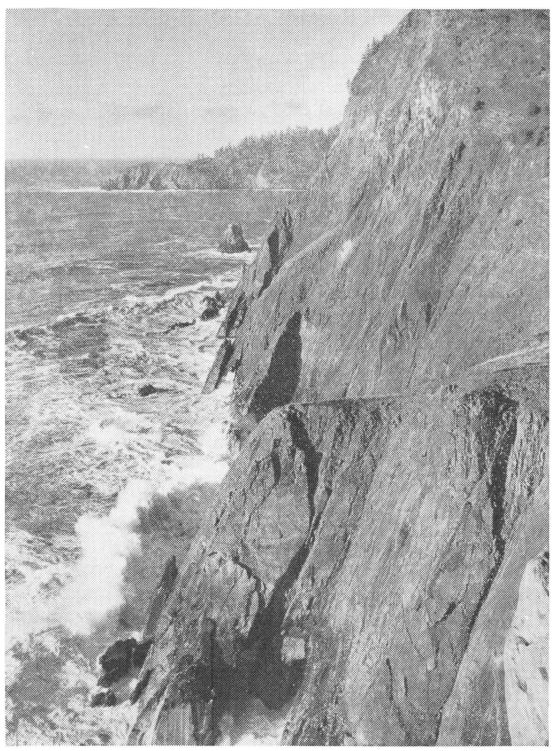
Way of Life. The Cliff Dwellers were short, black-haired people. Mothers strapped their babies to flat cradleboards. As a result, the backs of the Cliff Dwellers' heads were flattened. In summer, both men and women wore skirts woven from cotton, milkweed, and yucca fibers. In winter, they wore fur robes and blankets made of cords wrapped with turkey feathers or strips of rabbit skin.

The Cliff Dwellers farmed on the plains at the foot of their cliff homes or on the flat tops of the mesas above their dwellings. They grew beans, corn, cotton, squash, and tobacco and raised turkeys. They hunted deer and mountain sheep with arrows that had points of flaked stone. The people ate from pottery dishes and bowls that they painted with red or black designs.

Some Cliff Dwellers lived in caves that could provide shelter for several family groups, especially along river canyons. But most of these Indians lived in two- or three-story cliff houses. They built their homes on protected ledges or in hollow spaces in cliff walls, using sandstone blocks and mud mortar. They built the small rooms one upon another and set each story back a short distance from the edge of the one below. As many as 1,500 persons could live in some dwellings.

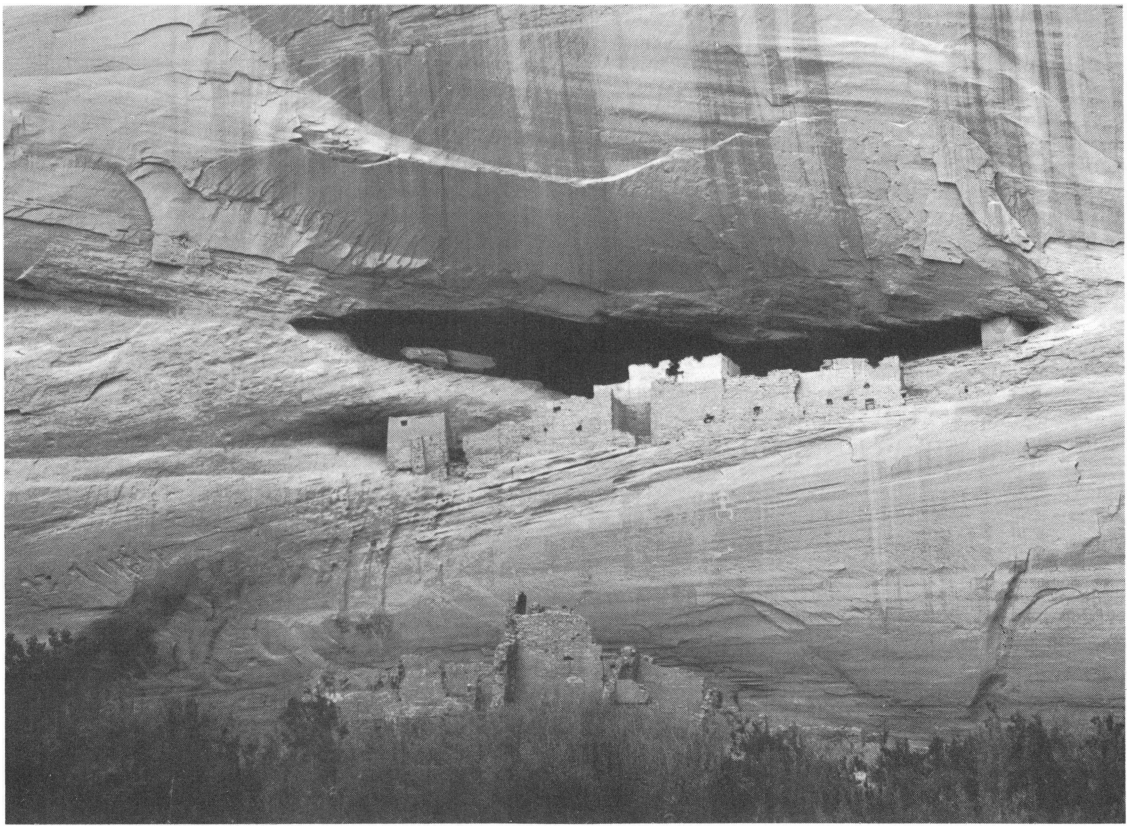
The cliff homes had few doors on the ground level. The people used ladders to reach the first roof. In case of attack, they drew up the ladders. Other ladders, steps, or winding paths were cut into the stone. They led from the caves and homes up to the tops of the mesas and down to the valleys.

Most of the villages had underground chambers called *kivas*, which the people entered through a hatchway in the roof. Men held councils in the kivas and also used them for secret religious ceremonies. The people plastered the walls and painted many with symbolic paintings in red, white, green, and yellow. The eastern Cliff Dwellers had round kivas, but the Cliff Dwell-



Ray Atkeson

Sheer Rocky Cliffs Rise from the Pacific Ocean on the slopes of Neahkahnie Mountain, in northwest Oregon.



Ray Atkeson

The "White House" of the Ancient Cliff Dwellers is the largest of nearly 100 such ruins. The dwelling stands in the Canyon de Chelly National Monument in northeastern Arizona.

ers in the south and the west built rectangular ones.

History. The most famous cliff dwellings were built by a group called the *Anasazi*. The earliest members of this group, known as *Basket Makers*, began farming in northern New Mexico, northern Arizona, southern Utah, and southern Colorado about the time of Christ. They gradually developed a type of many-storied dwelling called a *pueblo*. For this reason, all groups in Anasazi history after about A.D. 700 are called *Pueblo Indians* (see PUEBLO INDIANS).

About A.D. 1000, some groups of Pueblo Indians moved into the hills and built their homes in cliffs, perhaps for protection against their enemies. During the next 300 years the Anasazi culture reached its highest point among both these Cliff Dwellers and the other Pueblo Indians who had remained on the plains. The cliff-dwelling Anasazi Indians abandoned their houses by 1300, perhaps because of increased enemy attacks and a period of severe drought. They moved southward and built pueblo villages there. Other Indian groups of south-central Arizona and northern Mexico also built cliff dwellings, some of which were occupied as late as 1450. JOE BEN WHEAT

See the *Places to Visit* section of the ARIZONA, COLORADO, NEW MEXICO, and UTAH articles for the national monuments that include ruins of cliff dwellings.

CLIFFORD, CLARK McADAMS (1906-), served as United States secretary of defense under President Lyndon B. Johnson from March, 1968, to January, 1969. In that short time, Clifford became the leader of a group of officials who persuaded Johnson to de-escalate the Vietnam War. Clifford argued that the burden of fighting should be transferred from U.S. troops to South Vietnamese forces as quickly as possible.

Clifford was born in Fort Scott, Kans. He received a law degree from Washington University in St. Louis in 1928, and practiced law in St. Louis until he entered the Navy in 1944. Clifford began his public career in 1946 as special counsel and speechwriter to President Harry S. Truman. He helped draft the legislation that created the Department of Defense in 1949. Between his periods in government, Clifford has practiced law in Washington, D.C. CHARLES BARTLETT

CLIFFS OF DOVER. See DOVER.

CLIFTON, N.J. (pop. 82,437), is an industrial and manufacturing center. It lies 12 miles (19 kilometers) northwest of New York City, between Paterson and Passaic, N.J. (see NEW JERSEY [political map]). Clifton, Passaic, and Paterson form a metropolitan area with a population of 460,782. A railroad and several highways carry Clifton's factory and mill products to markets in surrounding cities. These products include batteries, boxcars, chemicals, clothing, electronic equipment, metal products, pharmaceuticals, scales, and stained glass. Clifton became a city in 1917. It has a council-manager government. RICHARD P. MCCORMICK

CLIMATE

CLIMATE is the average weather in an area during a long period of time. Scientists often describe climate in terms of an area's average monthly and yearly (1) temperatures and (2) amounts of *precipitation*. Precipitation consists of rain, snow, and other forms of moisture that fall to the earth.

Climate and weather are not the same. Weather is the condition of the atmosphere during a brief period. The weather may change from day to day. One day's weather may be stormy, wet, and cool. The next day's may be sunny, dry, and somewhat warmer. To determine the climate of an area, scientists study the daily weather conditions over many years.

Every place on the earth, no matter how small, has its own climate. Places that lie far apart may have a similar climate. Yet there may be important differences between the climate of a hill and a nearby valley, or of a city and the surrounding countryside.

The Importance of Climate

Wherever a person lives, climate affects his way of life. For example, it influences the kinds of clothing he wears and the kinds of food he grows and eats. It also influences the kind of home he lives in and the kinds of transportation he uses. In addition, climate helps determine the kinds of animals and plants that live in an area.

Clothing and Climate. People wear clothing that protects them against the climate of their area. In warm regions, people wear clothes made of a lightweight material, such as cotton or linen. Much of the clothing in warm regions is white or light-colored because these colors reflect the sun's rays. In cold regions, people wear heavy clothing made of such materials as fur or wool. People of the Arabian deserts wear loose, flowing robes that protect them from both the hot days and the cold nights of the desert. In regions that have cold winters and warm summers, people wear heavy clothing in winter and light clothing in summer.

Food and Climate. Most food crops grow best in areas that have a certain climate. A mild, fairly dry climate is best for growing wheat. Rice thrives in a warm, rainy climate. Many orchards are planted on a hillside, rather than in a nearby valley. Frost, which may damage fruit, occurs more often in valleys than on hillsides.

Housing and Climate. Homes provide protection against the climate. People who live in an area with a hot season and a cold season build sturdy, well-insulated housing that keeps out both heat and cold. In hot, dry regions, people build houses with extra-thick walls that keep out the heat. In rainy places, houses may have a steep, pointed roof so that rain can run off easily.

Transportation and Climate. In many places, the climate helps determine the kind of transportation that people use. For example, the people who live near the equator in west-central Africa travel largely by boat along the rivers. This area has a hot, wet climate, and so plants and trees grow quickly. The heavy rains and thick forests hamper the construction and maintenance of roads and railroads. People who live in cold, snowy areas often use skis, sleds, or snowmobiles for transportation.

Animal Life and Climate. Certain animals have adapted to life in certain climates. For example, camels live in the hot, dry deserts of Africa and Asia. These animals can go without water for days or even months. Crocodiles live in rivers, swamps, and marshes in hot regions, including parts of Central America. Polar bears live in the Arctic, and penguins live in Antarctica. Both the Arctic and Antarctica have an extremely cold climate.

Plant Life and Climate. Plant life also varies with the climate. Cacti grow chiefly in areas that are hot and dry. These plants differ greatly from the evergreens

HOW CLIMATE AFFECTS WAYS OF LIFE

Jeffrey Foxx, Woodfin Camp, Inc.

Cool Autumns are part of New England's *continental moist* climate. A tightly built house keeps out the cool air. Many people frequently wear a lightweight coat for warmth outdoors.

Joe Rychetnik, Van Cleve Photography

Long, Cold Winters are common in areas of Alaska that have a *polar* climate. Sturdy wooden homes provide protection from the cold, and people wear clothing of such materials as fur or wool.

of cold northern regions. The beech and maple forests that thrive in the climate of New England differ from the grasslands of the Midwest. Tall trees grow in the warm, rainy climate of many regions near the equator. But only mosses and other small plants can live in the extremely cold areas near the North and South poles.

Describing and Classifying Climates

The study of climate is called *climatology*, and scientists who specialize in climate are known as *climatologists*. In describing the climate of a certain place, a climatologist considers a number of characteristics of the atmosphere. The most important of these are temperature, precipitation, humidity, sunshine, and wind. Other characteristics include air pressure and cloudiness.

Climatologists often describe climate in terms of average yearly temperature and precipitation. But they also must consider seasonal variations in both. Such variations give special characteristics to the climate of certain places. For example, the average yearly temperature in both St. Louis and San Francisco is about 55° F. (13° C). Yet these two cities have different climates. St. Louis has fairly cold winters and hot summers, with precipitation the year around. San Francisco, on the other hand, has mild, rainy winters, and cool, almost rainless summers.

Climatologists have developed various systems of climatic classification. However, many of these experts recognize 12 major kinds of climate: (1) tropical wet, (2) tropical wet and dry, (3) highlands, (4) desert, (5) steppe, (6) subtropical dry summer, (7) subtropical moist, (8) oceanic moist, (9) continental moist, (10) subarctic, (11) polar, and (12) icecap. The World Map with this article shows the locations of these climates. But the map does not show differences within each major kind of climate. For example, New England and part of the Midwest have the same general kind of climate—continental moist. That is, these areas generally have warm to cool summers and cold winters, with moderate precipitation in all seasons. However, there are a number of differences between the climate of New England and that of the Midwest.

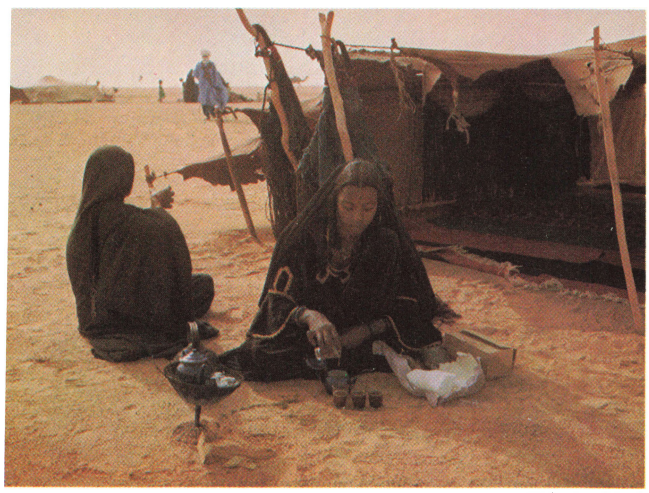
Why Climates Differ

In addition to describing and classifying climates, climatologists try to learn why the climate of one place differs from that of another. They have determined that climates differ for a number of reasons, including (1) differences in latitude, (2) differences in land and water temperatures, and (3) differences in the surface of the land. Latitude ranks as the main factor.

Differences in Latitude affect climate in a number of ways. Most importantly, places at different distances from the equator receive different amounts of heat from the sun. This situation occurs because the position of the sun in the sky varies with latitude. In areas that are near the equator—between the Tropic of Cancer and the Tropic of Capricorn on the map—the sun shines almost directly overhead at noon throughout the entire year. The direct rays from the sun shine intensely, and so they produce high temperatures on the ground. Therefore, most regions near the equator have a warm to hot climate. See TROPIC OF CANCER; TROPIC OF CAPRICORN.

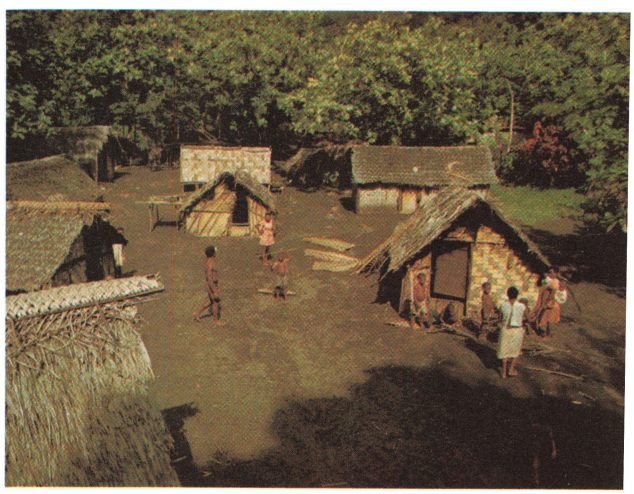
The sun never rises far above the horizon in areas near the North and South poles—north of the Arctic Circle and south of the Antarctic Circle on the map. Because the sun is low in the sky, its rays are slanted. Slanted rays shine less intensely than direct rays do, and so they produce lower temperatures. Therefore, the regions near the poles generally have a cold climate. See ANTARCTIC CIRCLE; ARCTIC CIRCLE.

Regions in the *middle latitudes* tend to have temperatures between those of areas near the equator and those



Victor Englebert

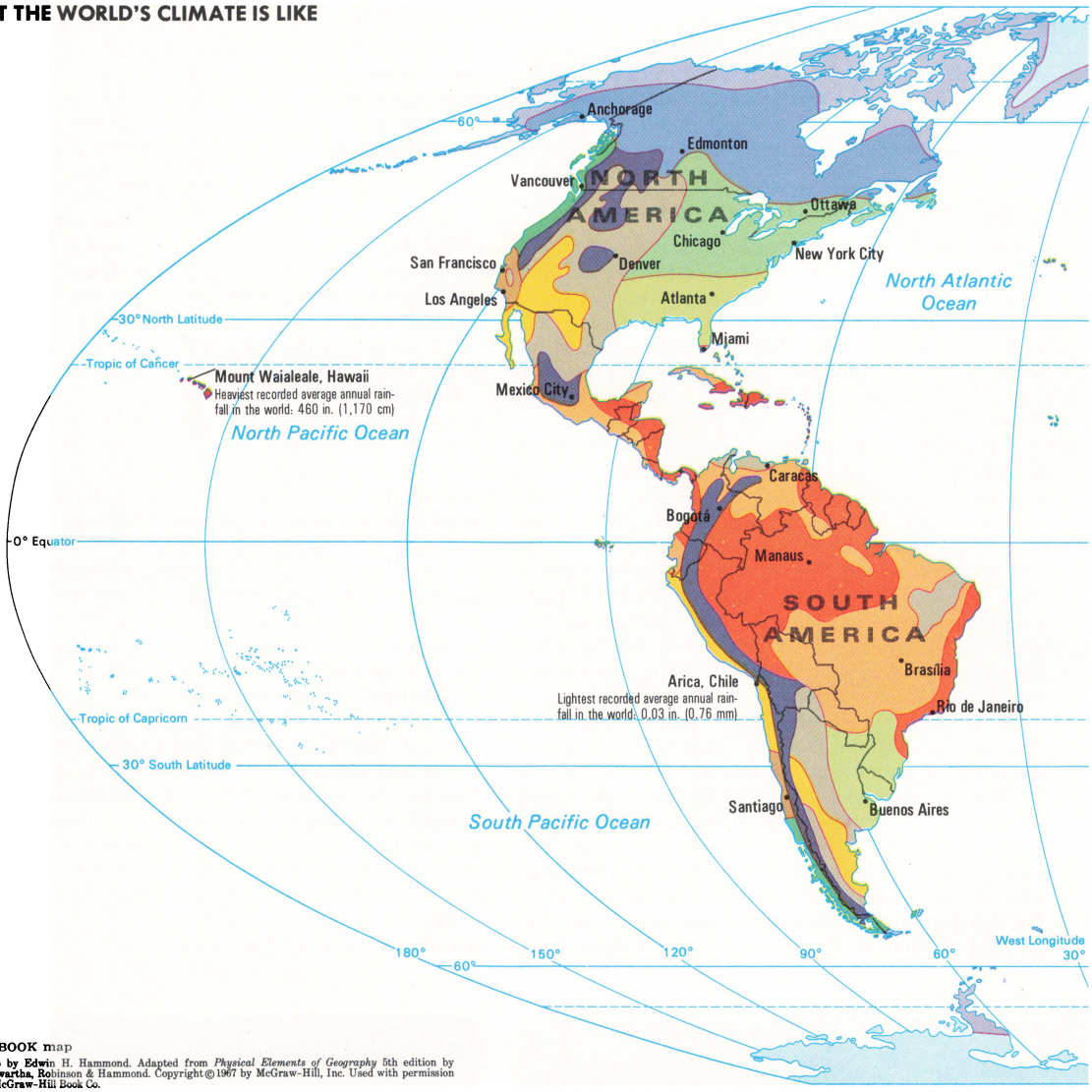
People of the Sahara, including these Tuareg women, wear loose, flowing garments. Such clothing protects them from both the heat and the cold of a *desert* climate. Their tent provides shade.



Kal Muller, Woodfin Camp, Inc.

In the New Hebrides Islands, houses have a thatch roof to keep rain from dripping in. These southwest Pacific islands have a *tropical wet* climate. The people wear little clothing.

WHAT THE WORLD'S CLIMATE IS LIKE



WORLD BOOK map

Source: Map by Edwin H. Hammond. Adapted from *Physical Elements of Geography* 5th edition by Trewartha, Robinson & Hammond. Copyright © 1967 by McGraw-Hill, Inc. Used with permission of McGraw-Hill Book Co.

Tropical Wet–Always hot, always wet. Heavy precipitation well distributed throughout the year.

Tropical Wet and Dry–Always hot, with alternate wet and dry seasons. Heavy precipitation in the wet season.

Highlands–These areas are affected by altitude and are generally cooler and wetter than the adjacent climates.

Desert–Hot to cold, with great changes in daily temperature except in coastal areas. Very little precipitation.

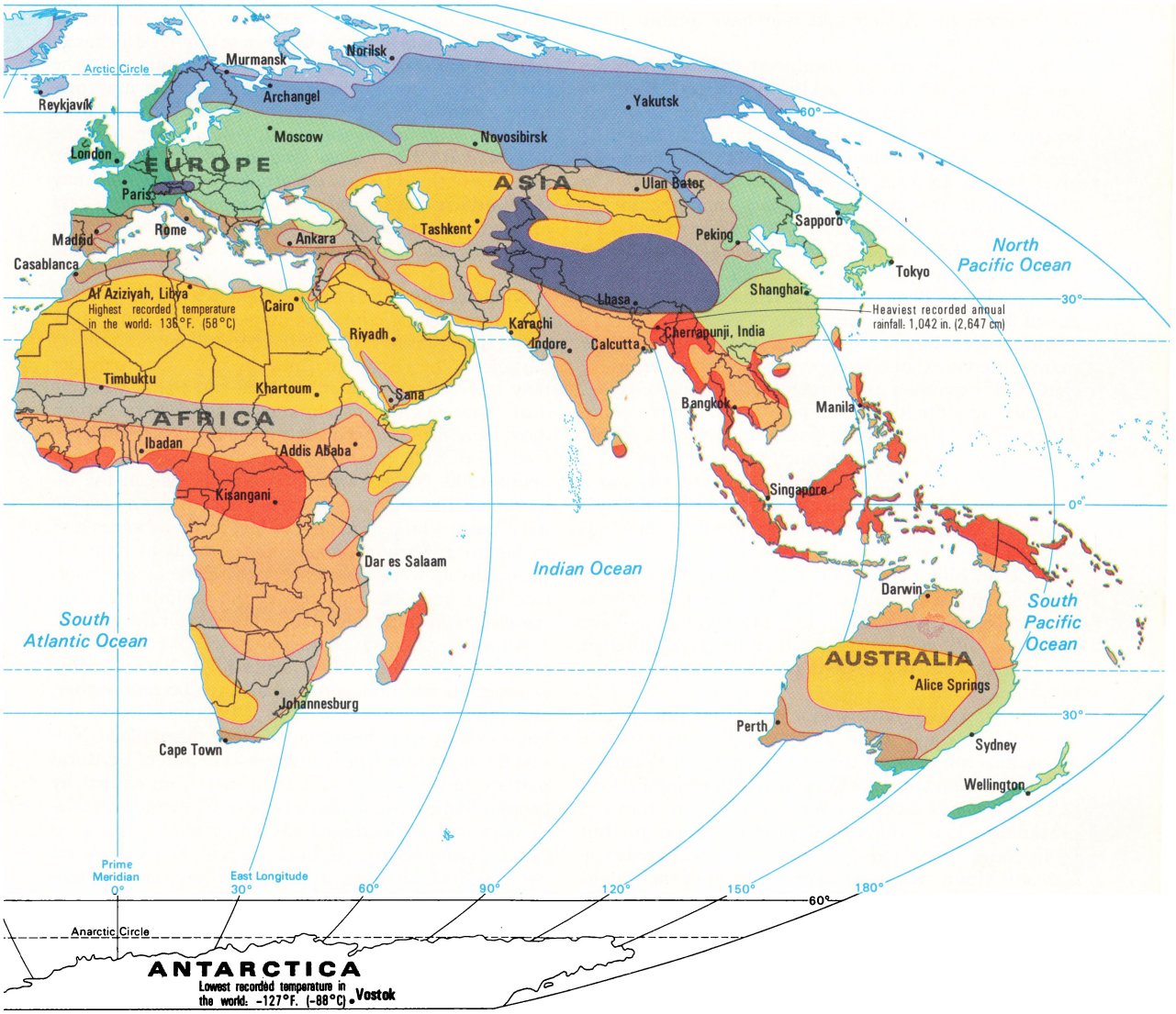
Steppe–Hot to cold, with great changes in daily temperature except in coastal areas. Little precipitation.

Subtropical Dry Summer–Hot, dry summers and mild, rainy winters. Moderate precipitation in winter.

of areas near the poles. The middle latitudes lie between the Arctic Circle and the Tropic of Cancer in the Northern Hemisphere, and between the Antarctic Circle and the Tropic of Capricorn in the Southern Hemisphere.

Places at different distances from the equator may also receive different amounts of precipitation. The air absorbs the greatest amount of moisture from warm parts of the ocean near the equator. Much of this moisture later falls to the nearby ground as rain. As a result, most of the wettest places in the world are near the equator. On the other hand, only light precipitation occurs in areas near the poles.

In addition, places at different distances from the equator may have different kinds of wind. Wind results from the uneven heating of the air around the earth. Air heated by the sun expands and rises, and cooler air flows in to take its place. This circulation process produces belts of prevailing winds. In areas near the equator, the prevailing winds tend to blow from



Subtropical Moist–Warm to hot summers and cool winters. Moderate precipitation in all seasons.

Oceanic Moist–Moderately warm summer and mild, cool winter. Moderate precipitation in all seasons.

Continental Moist–Warm to cool summer and cold winter. Moderate precipitation in all seasons.

Subarctic–Short, cool summer and long, cold winter. Light to moderate precipitation, mostly in summer.

Polar–Always cold, with a brief chilly summer. Little precipitation in all seasons.

Icecap–Always cold, average monthly temperature never above freezing. Precipitation always in the form of snow.

east to west. In the middle latitudes, these winds blow from west to east. Climatologists believe the prevailing winds in areas near the poles blow from east to west. But these winds are weaker than the east winds near the equator. Wind affects an area's cloudiness, humidity, precipitation, and temperature. As a result, areas that have different prevailing winds may have different climates. See WIND (General Circulation).

Differences in Land and Water Temperatures. In spite of the importance of latitude in determining climate, two places at the same latitude may have different climates. This situation may occur if one place is in the inland area of a continent and the other is in a coastal area. Water heats and cools more slowly than land does. In summer, bodies of water do not become so warm as the land, and in winter they do not become so cold. As a result, the inland area of a continent may be warmer in summer than the coast, which is cooled by the ocean air. In winter, the inland area of a continent may be colder than the coast, which is warmed

by the ocean air. A large lake may have similar effects on nearby land.

Bergen, a city on the southwest coast of Norway, lies about 1,315 miles (2,116 kilometers) north of Omaha, Nebr. Because Bergen is farther from the equator than Omaha is, the Norwegian city might be expected to have a colder, drier climate. But ocean air gives Bergen an average January temperature that is higher than the average January temperature in Omaha. Ocean air also keeps Bergen's average July temperature lower than Omaha's. Moist ocean winds bring a yearly average of 80 inches (203 centimeters) of precipitation to Bergen. Omaha receives a yearly average of 25 inches (64 centimeters).

Differences in the Surface of the Land result in many differences among climates. For example, as air rises and expands, its temperature becomes colder. Cold air cannot hold so much moisture as warm air can. Therefore, air that rises to pass over a mountain becomes colder and may lose much of its moisture. As a result, a place located on a mountain generally has a cooler, wetter climate than does a place at a lower elevation. Mountain slopes that face moist ocean winds have especially heavy precipitation.

Places in hilly or mountainous regions have a *highlands* climate. This kind of climate cannot be defined exactly. Nearby places in a highlands region may have somewhat different climates if they lie (1) at different elevations, or (2) in different positions relative to the prevailing winds.

Mountains may have major effects on the climate of nearby lowland areas. For example, the Cascade Mountains run through western Oregon and Washington. The lowland areas of Oregon and Washington west of the Cascades receive much precipitation from the prevailing winds, which blow in from the ocean. But by the time these winds have moved eastward over the Cascade Mountains, they have lost most of their moisture. As a result, some parts of eastern Oregon and Washington have a dry climate.

Differences in climate may occur even within a small, fairly level area. Such differences result from small differences in the surface of the land. In the Northern Hemisphere, gently sloping land that faces north has a somewhat cooler climate than does a slope that faces south, toward the equator. Also, the center of a large city is generally warmer than the surrounding region. Automobiles and the heating systems of buildings produce a large amount of heat in the city. In addition, such surfaces as pavements and the walls of buildings absorb much energy from the sun and thus heat the lower air.

The Changing Climate

Changes in climate take place slowly through the years. For example, the climate of many areas of North America was somewhat colder in the 1960's and early 1970's than in the 1930's and 1940's. This change formed part of a worldwide cooling pattern that began in the late 1940's. Yet the climate of North America is much warmer today than it was about 15,000 years ago. At that time, glaciers covered much of what is now Canada and the northern United States.

Climatologists believe there may be a number of causes of climatic change. One cause might be a change in the amount of energy given off by the sun or in the earth's orbit around the sun. Such changes may produce a variation in the amount of heat received from the sun. Another cause of climatic change may be *volcanic dust.* When a volcano erupts, it throws huge amounts of this dust into the atmosphere. The dust may stay in the air for several years, scattering the sun's rays and so reducing the amount of sunlight that reaches the ground. Thus, a volcanic eruption may have cooling effects.

Some climatologists think people play an important part in producing climatic changes. For example, agricultural and industrial activity causes large amounts of particles to be discharged into the air. These particles may have effects similar to those caused by volcanic dust. Another cause of climatic change may be carbon dioxide, a gas that occurs naturally in the atmosphere. Carbon dioxide is also produced by burning. Since about 1900, the amount of carbon dioxide in the atmosphere has increased considerably because people have burned large amounts of fuel in their homes and in factories. Carbon dioxide allows sunlight to reach the earth and warm its surface, but it prevents some surface heat from escaping out of the atmosphere. This *greenhouse effect* may raise temperatures near the ground.

Although a general cooling of the earth's climate has occurred since the 1940's, some areas have become warmer. In addition, some areas have become wetter, and others have become drier. Climatologists do not know exactly why these changes have taken place. Neither do they know which changes form part of a natural pattern and which ones, if any, have been caused by people. Some climatologists believe temperature variations caused by increased carbon dioxide or particles in the air may have brought changes in the earth's wind systems. Such changes, in turn, may have caused various kinds of climatic changes.

Climatologists want to learn why climatic changes occur, chiefly because some of these changes could hurt man's food production. Knowledge of what is involved in such changes may help scientists prepare for them.

LYLE H. HORN

Related Articles. See the section on *Climate* in the various state, province, country, and continent articles, such as ALABAMA (Climate). See also WEATHER with its list of *Related Articles.* Other related articles in WORLD BOOK include:

Acclimatization
Animal (Where Animals Live; Animals and Climate)
Arctic (Climate)
Clothing (Protection)
Desert
Ecology (A Biome)
Food (Geography and Food)
Gulf Stream
Ice Age
Icecap
Isotherm
Lake (Climate)
Latitude
Meteorology
Ocean (The Ocean and Climate)
Phenology
Plant (Where Plants Live)
Races of Man (Race and Climate)
Rain
Season
Shelter (Climate)
Snow
Temperature
Transportation (Climate and Weather)
Tropics
Wind
Zone (Climatic Zone)

CLIMATOLOGY. See CLIMATE.

CLIMATRON. See MISSOURI (Places to Visit; picture).

CLINGMANS DOME is the highest peak in the Great Smokies and in Tennessee. The mountain rises 6,643 feet (2,025 meters) on the Tennessee-North Carolina boundary, about 35 miles (56 kilometers) southeast of Knoxville. For location, see TENNESSEE (physical map). The Clingmans Dome area is a resort region with a variety of plants, cool streams, and wooded mountain scenery. Perhaps the most spectacular trip in Great Smoky Mountains National Park is the climb from Gatlinburg, Tenn., past Newfound Gap to Clingmans Dome. E. WILLARD MILLER

See also TENNESSEE (color picture).

CLINICAL PSYCHOLOGY is concerned with the psychological adjustment of the individual to himself and his environment. Clinical psychologists deal with both normal and abnormal behavior. They administer and interpret psychological tests, and diagnose and treat mental disorders. They also study the structure and development of personality, and work to prevent serious disturbances in mental health.

Clinical psychology is an *applied* field of psychology. That is, it puts into practice the theories developed in the different fields of psychology. For example, clinical psychologists apply many findings of abnormal psychology when they diagnose and treat mental disorders. They also draw knowledge from the fields of learning, motivation, perception, personality, developmental psychology, physiological psychology, and social psychology. The chief activities of clinical psychology are (1) testing and diagnosis, (2) psychotherapy and consultation, and (3) research.

Testing and Diagnosis. Clinical psychologists administer and interpret tests that measure aptitude, intelligence, and personality. Through their interpretation of test results, they help determine proper school placement for students of all ages. They also help employers determine people's aptitudes for certain kinds of jobs. Clinical psychologists also use personality tests in diagnosing mental disorders. See TESTING.

Psychotherapy and Consultation. Clinical psychologists treat only mental disorders that result from disturbed human relationships rather than from biological causes. They deal with brief, minor disturbances such as stress resulting from a school failure or grief due to the loss of a loved one. They also try to solve the prolonged problems of *neuroses* (mild personality disorders) and *psychoses* (severe personality disorders).

Psychotherapy is the clinical psychologist's chief tool in treating mental disorders. In most kinds of psychotherapy, the psychologist talks with the patient in a series of informal interviews. In most cases, the psychologist tries to help his patient understand the cause of his personality disturbance (see MENTAL ILLNESS [How Mental Illnesses Are Treated]).

Preventing mental disorders is an important goal of the clinical psychologist. He develops and takes part in consultation programs to educate the public in methods of improving and expanding mental health facilities. He also works with the clergy, teachers, and other persons who deal with children to help identify and solve psychological problems at an early stage.

Research. Clinical psychologists are trained to design and conduct scientific experiments. Through their knowledge and use of research techniques, they improve various methods of diagnosing and treating mental disorders. They propose new theories on the structure and development of personality. They also develop and evaluate new testing methods. IRVING E. ALEXANDER

See also MENTAL ILLNESS with its list of Related Articles.

CLINKER. See CEMENT AND CONCRETE (How Cement Is Made).

CLINKER-BUILT VESSEL. See SHIP (Viking Ships).

CLINTON, DE WITT (1769-1828), an American statesman, promoted the building of the Erie Canal. As early as 1809, he advocated building the canal. He served as a canal commissioner during the early years of its construction. The canal was completed in 1825, while Clinton was governor of New York. See ERIE CANAL.

Clinton was born in Little Britain, N.Y. He was graduated from Columbia College, and then studied law. He served as private secretary to his uncle, George Clinton, then governor of New York. He developed a strong interest in politics. In 1797, he was elected to the state assembly, and in the following year, he served in the state senate. In 1802, Clinton was sent to the United States Senate to fill a vacancy. The next year, he resigned his seat to become mayor of New York City. He was mayor from 1803 to 1815, except for two short intervals when he served in the New York Senate and was lieutenant governor of the state. In 1812, Clinton was an unsuccessful Federalist candidate for President of the United States. He served as governor of New York from 1817 to 1822 and from 1825 to 1828. During the time Clinton was governor, a school system was established. W. B. HESSELTINE

Detail of an oil portrait (1826) by Samuel F. B. Morse; The Metropolitan Museum of Art, New York City, Rogers Fund, 1909

De Witt Clinton

CLINTON, GEORGE (1739-1812), an American statesman and soldier, served as Vice-President of the United States from 1805 until his death. He served under two different Presidents, Thomas Jefferson and James Madison. Only one other Vice-President, John C. Calhoun, shares this record (see CALHOUN, JOHN C.).

Clinton also served as the first governor of New York. He was elected in 1777 after New York's constitutional convention, and won re-election six consecutive times, a record that still stands. Clinton strongly believed in states' rights, and at first opposed New York's ratification of the United States Constitution. Under the name "Cato," he published several letters against adoption of the Constitution. Alexander Hamilton started *The Federalist* papers largely to answer Clinton's objections (see HAMILTON, ALEXANDER).

Clinton was born in Little Britain, N.Y. He served as a brigadier general in the Continental Army in 1777. He also was a member of the New York Assembly and the Continental Congress. A statue of Clinton represents New York in the U.S. Capitol. IRVING G. WILLIAMS

See also VICE-PRESIDENT OF THE U.S. (picture).

CLINTON, SIR HENRY (1730-1795), served as commander in chief of the British Army for four years dur-

ing the Revolutionary War. He retreated from Philadelphia to New York, and stayed there about two years. Then in 1780 he invaded South Carolina and captured Charleston. He returned to New York, leaving Lord Cornwallis in command in the South. After Cornwallis surrendered in 1781 at Yorktown, Clinton resigned. He was blamed for Cornwallis' defeat. Clinton was born in Newfoundland. See also CORNWALLIS, CHARLES. W. B. WILLCOX

CLIO. See MUSE.

CLIPPER SHIP was a fast, slender sailing vessel that was developed in the United States in the mid-1800's. To be classed a clipper, a ship needed a narrow *hull* (body) designed for speed, and many large sails mounted on tall *masts* (sail poles). Clipper ships were modeled after the "Baltimore Clippers," small, swift sailing ships developed on Chesapeake Bay for sea use. The name *clipper* came from the way the ships "clipped off" the miles. Traders used clipper ships to bring tea and opium from China, and wool and gold from Australia. Clipper ships carried passengers across the Atlantic Ocean, and around Cape Horn to California during the gold rush of 1849-1857.

The *Rainbow*, designed by John W. Griffiths and launched in 1845, was the first true clipper ship. It was much larger and faster than the earlier "Baltimore Clippers." Other famous clipper ships included the *Sea Witch* and the *Cutty Sark*.

Perhaps the most famous builder of clipper ships was Donald McKay, a Canadian. McKay did most of his work in East Boston. His ships included the *Flying Cloud*, *Stag Hound*, *Lightning*, *Sovereign of the Seas*, and *Great Republic*. When launched in 1853, the *Great Republic* was the largest sailing ship in the world. It was 325 feet (99 meters) long and carried a crew of 130.

Some typical, fast clipper trips included a voyage across the Atlantic Ocean in 12 days, 6 hours by the *James Baines;* an 89-day, 4-hour voyage from New York City around Cape Horn to San Francisco by the *Andrew Jackson;* and a run of 465 miles (748 kilometers) in 24 hours by the *Champion of the Seas* in 1854. More than 25 years passed before a steamship beat the *Champion of the Seas*' record. Square-riggers, ships designed to carry larger cargoes at slower speeds, gradually replaced the graceful clipper ships in the late 1800's.

In aviation, certain types of transoceanic passenger airplanes were called clippers (see AIRPLANE [Engineering Improvements]). ROBERT H. BURGESS

See also SHIP (Clipper Ships); MAINE (picture: Ships Built in Maine).

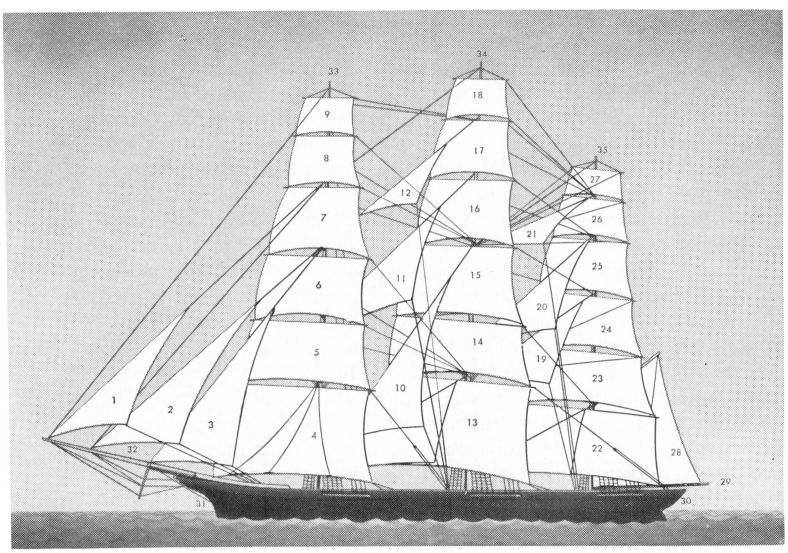
CLIPPERTON ISLAND is an isolated atoll in the northeast Pacific. It is 750 miles (1,210 kilometers) west of Acapulco, Mexico, and 1,300 miles (2,090 kilometers) northwest of the Galapagos Islands. It is uninhabited, and covers about 2 square miles (5 square kilometers). Spanish explorers discovered the island, but it is named for John Clipperton, an English pirate who made it his headquarters. It now belongs to France. In 1943, the United States Navy occupied Clipperton Island for the duration of World War II. EDWIN H. BRYAN, JR.

CLISTHENES. See CLEISTHENES.

CLIVE, ROBERT (1725-1774), BARON CLIVE OF PLASSEY, was the British administrator and military leader who brought India into the British Empire.

Clive was born in Shropshire, England. He joined the English East India Company, Britain's trading company in India, in 1743. In 1747, he received a commission in the company's armed services. The British and French trading companies were struggling for control of India, and Clive won several important victories over the French and their Indian allies. In 1757, he led 3,200 troops to victory over 50,000 enemy troops at the Battle of Plassey. This victory enabled the English to gain political control of Bengal, the richest province in India.

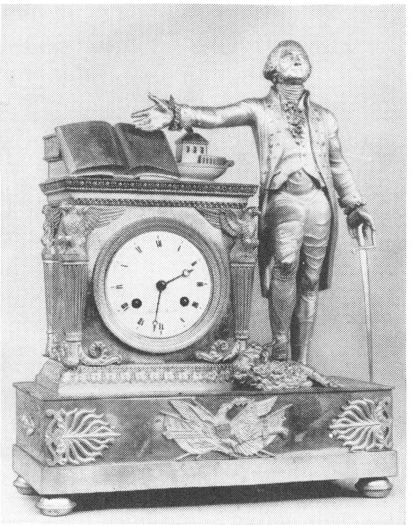
Clive returned to England in 1760 and entered Parliament. In 1773, some of Clive's enemies persuaded Parliament to investigate his career in India. The investigation showed that Clive had made a fortune, but that he had also rendered "great and meritorious service to his country." Sickness during the last year of his life caused Clive to become an opium addict. He committed suicide in 1774. BRIJEN K. GUPTA



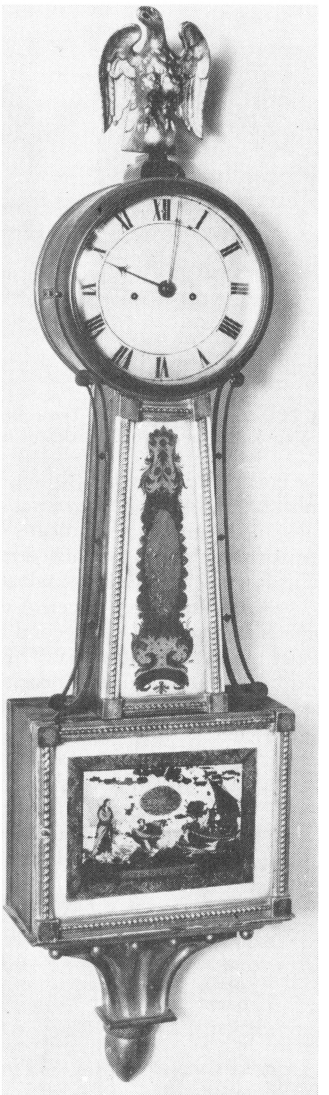
THE CLIPPER SHIP UNDER PLAIN SAIL

1 Flying Jib
2 Jib
3 Fore-topmast Staysail
4 Foresail
5 Lower Fore-topsail
6 Upper Fore-topsail
7 Fore-topgallant Sail
8 Foreroyal
9 Fore-skysail
10 Main-topmast Staysail
11 Main-topgallant Staysail
12 Main-royal Staysail
13 Mainsail
14 Lower Main Topsail
15 Upper Main Topsail
16 Main-topgallant Sail
17 Main Royal
18 Main Skysail
19 Mizzen-topmast Staysail
20 Mizzen-topgallant Staysail
21 Mizzen-royal Staysail
22 Mizzen Sail
23 Lower Mizzen Topsail
24 Upper Mizzen Topsail
25 Mizzen-topgallant Sail
26 Mizzen Royal
27 Mizzen Skysail
28 Spanker
29 Boom
30 Stern
31 Bow
32 Bowsprit
33 Foremast
34 Mainmast
35 Mizzenmast

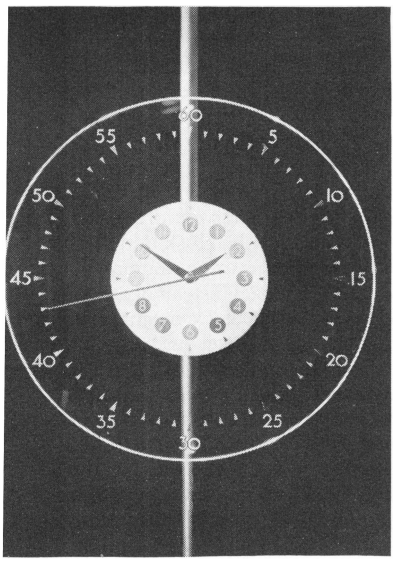
French Clock of about 1770 had a hand to show the days of the week.



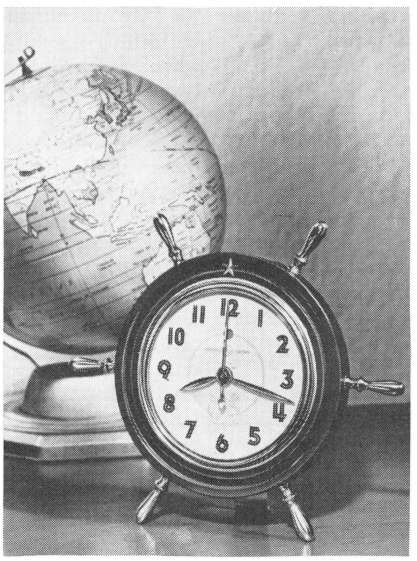
A French Clock of Gilded Bronze had a statue of George Washington on it.



An American Banjo Clock with a pendulum was made about 1815.



An Electric Clock has a dial made to resemble the dial of a telephone.



The Electric Clock uses a tiny motor instead of the complex mechanism of other clocks.

Metropolitan Museum of Art; Bell Telephone Company; General Electric Co.

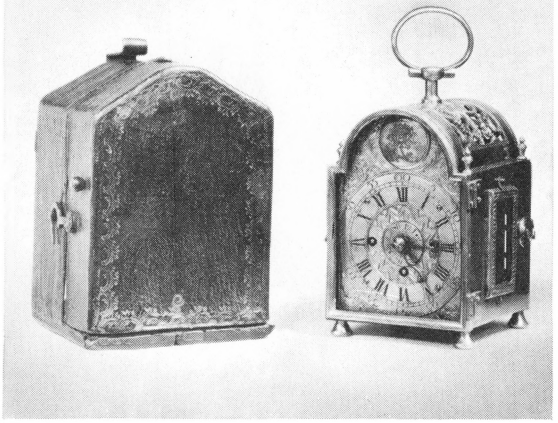
CLOCK is an instrument used for dividing the day and night into regular periods of time. The first clocks were the marked-off shadows of trees. When the shadow was short, the watchers could tell the time of day was near noon. When the shadows were long on either side, the day was either beginning or ending. Watching the shadows of a tree led to the making of the first sundial.

In order to measure time on cloudy days or during the night, the water clock or *clepsydra* was developed. This clock was used in China three thousand years ago. It was also known to the Egyptians, the Greeks, and the Romans. There were many forms of the water clock, but all of them worked about the same way. Water or some other fluid was made to run from one vessel to another. The amount of water that flowed could be measured to mark the passing of time.

In the 1300's Henry de Vick invented a clock which contained many of the important parts of the modern clock. It had wheels, a dial, and an hour hand. By 1700 a pendulum, a minute hand, and a second hand had been added to the clock. Since then the essential principles of clocks have not changed. Styles may vary, as in the tall grandfather clocks or the smaller mantle clocks. Clocks have become lighter and keep better time. Many modern clocks run by electricity.

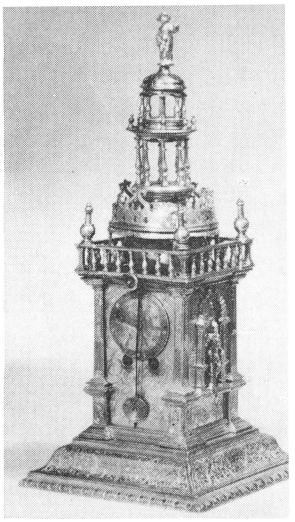
Parts of a Clock

The essential parts of a clock are a set of wheels and a weight or spring which moves the wheels. The front of the clock contains a face and a set of hands which point out the hours and minutes. Before a clock can be made to run, it must be wound. In a clock which moves by



A 200-Year-Old French Traveling Clock has a carrying case. The sturdily built clock was ideal for travelers.

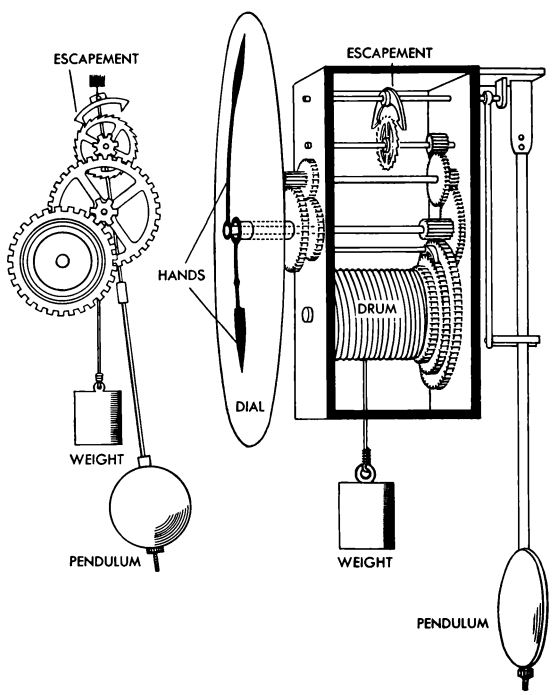
French Clock of the 1700's had rotating bands instead of a dial.



Metropolitan Museum of Art

German Clock of the 1500's was made of gilded bronze.

the energy produced by a falling weight, a chain or cord must be wound around a barrel or drum. As the weight falls, the drum turns. By means of gear teeth, the drum causes a small wheel, attached to a large wheel, to turn. This large wheel turns a small toothed wheel attached to still another larger wheel. A device called an *escapement* is connected to this second large wheel to keep the weight from falling too fast. This curved piece of metal has hooks called pallets on each end which fit into the second large wheel. The pendulum, as it swings from right to left, permits the second large wheel to move forward one tooth at a time as the device is tilted from side to side. The pendulum's swing is used to regulate the speed at which the wheels of the clock turn. The speed of the pendulum can be increased by moving its weight upward to shorten its pendulum. This makes the clock run faster. If the pendulum weight is lowered the pendulum swings more slowly and the clock runs more slowly.



Front and Side Views of the Mechanism of a Clock

One wheel turns around once every hour, and carries the long minute hand with it. The hour hand is moved by turning a small wheel with six teeth against a large wheel with 72 teeth. Thus, the minute hand turns twelve times while the wheel which moves the hour hand turns around once.

Spring Clocks. Clocks using only weights and pendulums were made for hundreds of years. This required that the clock remain in an upright position. Finally it was discovered that a small steel spring would provide enough energy to turn the wheels of the clock and thus permit the weight and the pendulum to be done away with. Spring clocks use a balance wheel instead of a pendulum to keep the wheels within the clock mechanism turning at an even rate. A balance wheel turns first in one direction and then in the opposite direction. A small hairspring attached to the wheel provides a counterforce which sends it backward. Small clocks and watches use a mainspring to provide the energy to run them. In order to operate such a clock, the spring must be tightened or wound. Some clocks have springs that need to be wound only once every eight days. One special type of clock can run 400 days with one winding.

Striking Clocks. The part of a clock that strikes the hours is separate from the part that keeps time. Many of the early clocks had no hands to point out the hours. The escapement principle mentioned above was used to strike a bell or gong. People told time by listening to the number of strokes of a bell. The word clock is closely related to the German word *Glocke* and the French word *cloche*, which both mean bell.

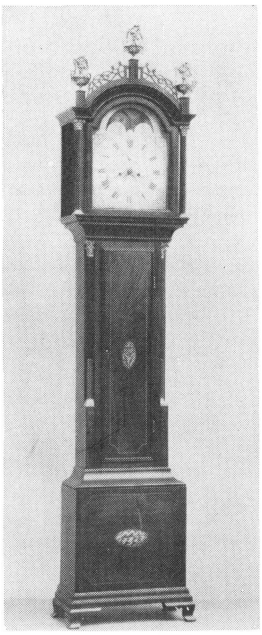
The bell on a striking clock is struck by a hammer which is connected to a weight or spring which moves the hammer at certain times. Some clocks have hammers that strike a series of chimes. Others set a group of figures in motion at regular intervals.

Cuckoo clocks have small wooden birds that come out of the clock and whistle the hours. Alarm clocks have striking devices which sound at any desired time.

Electric Clocks. Some electric clocks depend for their power on an alternating current of electricity. This current vibrates at an even rate of sixty times per second, which serves to keep the clocks exactly on time. A num-

ber of different clocks in different places also may be kept on the same time by a central electrical control. This is done by sending out a current which is timed with the pendulum of the master clock. The swinging of the pendulum controls electrical impulses which keep the wheels of the other clocks moving properly.

Atomic Clocks are the most accurate in the world. Some of them will gain or lose only a few seconds in 100,000 years. Instead of a pendulum or vibrations of electric current, atomic clocks are tuned to vibrations of atoms or molecules. These vibrations are so stable that they almost always vibrate the same number of times for each second. Atomic clocks are exceptionally accurate because they are tuned to these stable vibrations.



The Metropolitan Museum of Art

An Old Grandfather Clock, made in Roxbury, Mass., has a long pendulum enclosed in the tall, oblong, wooden case.

Many atomic clocks are tuned to masers. In one clock of this type, microwaves passing through ammonia gas tune the clock to the frequency of the ammonia atom. See MASER.

The first atomic clock was developed by scientists at the National Bureau of Standards in the late 1940's. See ATOMIC CLOCK.

Naval Observatory Clocks in Washington, D.C., are extremely accurate. They furnish the standard time for the entire country. The clocks are kept in underground chambers and are in direct contact with solid ground. They are protected by glass cylinders and regulated by slight changes in the pressure of the surrounding air. These clocks have nickel-steel alloy pendulums that can withstand air temperature changes. ARTHUR B. SINKLER

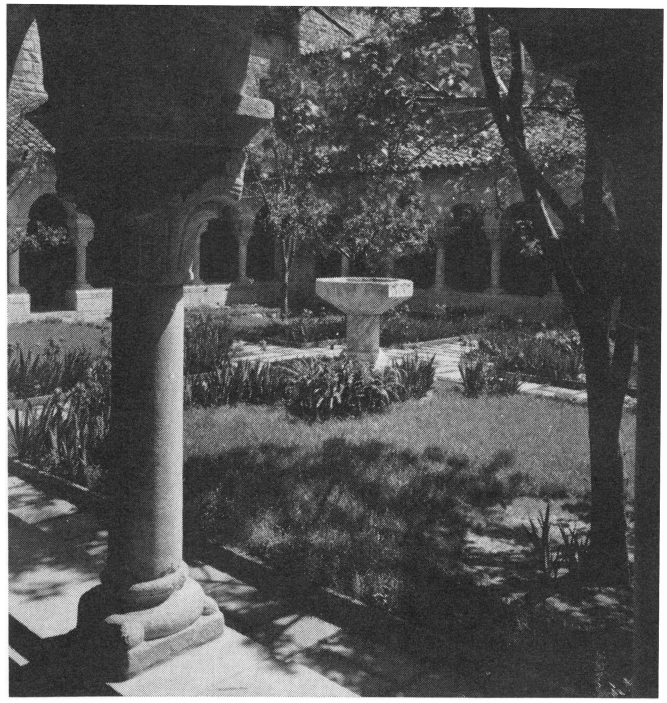
Related Articles in WORLD BOOK include:

Chronometer	Minute	Time
Horology	Pendulum	Watch
Hour	Sundial	Water Clock
Hourglass		

CLOISONNÉ. See ENAMEL (Decorative).

CLOISTER, *KLOIS tur,* is a covered walk, often built around the courtyard of a monastery, church, or college building. *Arcades* (rows of arches on columns) support the roof of a cloister. The open space surrounded by a cloister is called a *garth.* The word *cloister* is often used to mean the courtyard and the covered walk.

A monastery is sometimes called a cloister because the cloister was the heart of many monastic communities during the Middle Ages. Monks worked and meditated in the courtyard, which often contained a garden and a well. They walked through the cloister to go from one building to another. A church often adjoined the monastery on one side of the cloister. Rooms of the monastery itself opened off the three other sides.



The Metropolitan Museum of Art, New York

The Cloisters, in Fort Tryon Park in New York City, have been reconstructed from the ruins of medieval European cloisters.

These rooms included the *sacristy,* where the sacred utensils were kept, and the *chapter house,* where the monks transacted official business. There was a *calefactory* (heated room) used for recreation, and a *parlor* where monks could talk if speaking were restricted elsewhere. A *refectory* (dining hall) usually ran along one side of the cloister, with a kitchen and pantry beyond. The windows of sleeping cells or a dormitory on the upper floor opened onto the cloister. There was also a library and study cubicles. The cloister often served as a graveyard for the monks. ALAN GOWANS

See also NEW YORK CITY (Museums).

CLOISTERS. See METROPOLITAN MUSEUM OF ART.

CLOSED CIRCUIT. See ELECTRIC CIRCUIT.

CLOSED PRIMARY. See PRIMARY ELECTION (Open and Closed).

CLOSED SEASON. See GAME.

CLOSED SHOP is a workshop or an industry in which only members of a labor union may be hired. In some closed shops, the union supplies all of the employees. When employees must be replaced, or new ones are needed, the employer obtains them through union headquarters. In a *union shop,* an employer may hire nonunion employees, but the new workers must join the union within a short period of time after they have been hired. The closed shop was declared illegal by the Taft-Hartley Act of 1947. However, the union shop is not illegal. See also TAFT-HARTLEY ACT; OPEN SHOP; UNION SHOP. GERALD G. SOMERS

CLOSURE. See CLOTURE.

CLOT. See BLOOD (Blood Clotting); ANTICOAGULANT; COAGULANT; FIBRIN.

CLOTH. See TEXTILE; COTTON (Making Cotton into Cloth).

CLOTHES DRYER. See LAUNDRY; APPLIANCES.

CLOTHES MOTH. See MOTH (Clothes Moths).

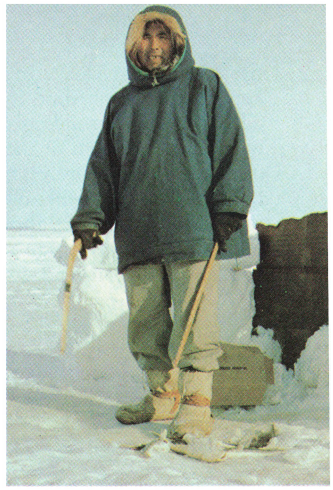
CLOTHIER'S BRUSH. See TEASEL.

Bruno Barbey, Magnum

Masai People in Kenya

WORLD BOOK photo

Shoppers in the United States



Design Photographers International

Eskimo in Alaska

D. Seymour, Magnum

Bullfighters in Spain

W. King, FPG

Women in Morocco

Clothing Is One of Man's Most Important Needs. Most people wear some kind of garments, accessories, or ornaments. People in different parts of the world wear many different types of clothes. This worldwide variety occurs because individuals have different purposes for wearing clothes, use different materials and methods for making clothes, and follow different clothing customs.

CLOTHING

CLOTHING includes all the different garments, accessories, and ornaments worn by people throughout the world. An Eskimo may wear boots, warm pants, and a heavy coat. An African in a village may wear only a necklace and a piece of cloth tied around the waist. A nurse may wear a white uniform, cap, and shoes. A London banker may wear a business suit and a hat. Each of these persons dresses differently, but they all feel a need to wear some kind of clothing. Like food and shelter, clothing is one of man's most important needs.

Throughout history, many people have worn clothing more for decoration than for covering the body. Even in cold climates, some people seem more interested in decorating their bodies than in protecting them. In the 1830's, for example, the famous British biologist Charles R. Darwin traveled to the islands of Tierra del Fuego, off the southern tip of South America. There he saw people who wore only a small cloak of animal skin and a little paint in spite of the cold rain and sleet. Darwin gave the people scarlet cloth, which they wrapped around their necks. Even in the cold weather, the people wore clothes more for decoration than for protection.

No one knows exactly why or when men first wore clothes. But they probably began to wear clothing more than 100,000 years ago—and probably for much the same reasons we wear clothes today. Early men may have wanted to protect themselves, to improve their appearance, and to tell other people something about themselves. A cave man may have worn the skin of a bear or a reindeer for warmth. He also could have worn the skin to show his neighbors that he was a great hunter and a brave, strong man.

By the end of the Old Stone Age—about 25,000 years ago—man had invented the needle, which enabled him to sew skins together into clothing. He had also learned to make yarn from the threadlike parts of

Mary Ellen Roach, the contributor of this article, is Professor of Textiles and Clothing at the University of Wisconsin and coeditor of Dress, Adornment, and the Social Order.

Marilyn Silverstone, Magnum

Women in India

Van Bucher, Photo Researchers

Schoolchildren in Japan

Björn Bölstad, Photo Researchers

Colorado Indian in Colombia

Camera Press, Pix

Ballet Dancers in Russia

WORLD BOOK photo by Lee Balterman

Football Players in the United States

some plants or from the fur or hair of some animals. In addition, he had learned to weave yarn into cloth. By this time, man had begun to raise plants that gave him a steady supply of materials for making yarn. He had also started to herd sheep and other animals that gave him wool. These few advances took thousands of years. Most changes in the ways of making clothing and in the materials used for clothing have come only during the last few hundred years.

Until about 200 years ago, man had no machines for making clothes. Most families made their own clothing. Sometimes businessmen paid groups of workers to make clothes, which the businessmen then sold. But most of the people who made clothes worked at home. There were no clothing factories.

During the late 1700's and 1800's, the invention of several machines brought the clothing industry out of the home and into the factory. Machines that could spin thread, weave cloth, and sew clothes led to the growth of the clothing industry. Today, people in most parts of the world can buy ready-to-wear garments made in large clothing factories.

The clothing industry is a giant business in many countries. Clothes and clothing materials are important items of trade between nations. Shoppers in many lands buy Italian knitwear and shoes, Australian wool, and Japanese silk. Stores throughout the world sell clothes designed in London, Paris, and Rome. As a result, many people in different countries—especially people who live in cities—wear similar clothes. But there are still differences in dress among most regions of the world.

People in various regions dress differently for many reasons. They may need protection from different kinds of weather. They may have different materials and methods for making clothes, or they may have different habits of dress.

This article discusses why people wear clothes, clothing around the world, and the history of clothing. Then it describes the clothing industry and the choosing and care of clothing. The article also tells of career opportunities in the clothing industry. For descriptions of the clothing worn by various peoples, see the many country articles in World Book.

Most people, no matter where they live, wear some kind of clothing. Any person may wear certain clothing for a variety of individual reasons. But in general, people wear clothes for three main reasons: (1) protection, (2) communication, and (3) decoration. Most clothing serves all three purposes.

Protection. Clothing helps protect people's physical and emotional health.

Physical Protection. Man has probably worn clothing for physical protection since he first put on animal skins, leaves, or other clothing materials. In many areas of the world, people need clothing for protection from the weather. Clothing also protects people who work on dangerous jobs, take part in rough sports, or engage in other hazardous activities.

In cold climates, people wear warm garments made of wool, fur, or closely woven fabrics. They also wear warm shoes or boots.

In warm climates, people wear clothes made of such lightweight materials as cotton or linen, which have a fairly open weave. These materials absorb perspiration and allow air to flow around the body. People in these climates sometimes wear white or light-colored clothes because such colors reflect the sun's rays. They may also wear sandals, which are more comfortable than shoes or heavy boots in warm weather. Large hats made of straw serve as sunshades.

In many places, people must wear clothes for protection against several kinds of weather. For example, people of the Arabian deserts wear loose, flowing garments that shield their bodies from the blazing sun. The same garments protect them against the cold night air. Even in less severe climates, people may require protective clothing during the hot and cold seasons.

NASA

Astronauts Wear Protective Clothing. The space suit worn by an astronaut on the moon protects him from both heat and cold. It also provides an artificial atmosphere in which he can live.

Certain activities require special protective clothing. A soldier in combat wears a steel or plastic helmet and a nylon vest lined with plastic sheeting or fiber glass. Welders wear protective shields over their faces. Astronauts wear special suits and helmets for protection against changes of air pressure and temperature. Factory workers wear heavy shoes to protect their feet. Football players wear padded equipment to guard against injury.

In some societies, people may wear clothing for protection against unusual types of physical harm. For example, people in France wore plain clothes during the French Revolution in the late 1700's. Revolutionaries might have thought that a person wearing fancy clothes belonged to the upper class, and they would probably have killed him. In some countries, people believe that evil spirits can cause bodily harm. These people may wear special clothes that they think have magic power to deal with such spirits.

Emotional Protection. Clothing protects people's emotional health by helping satisfy some of their needs. For example, most people need to feel they are accepted as members of society or of some special group. Many persons also want to feel they are independent individuals—different in at least some small way from everyone else.

A person who wants to belong to a certain group usually dresses in a style similar to that of people in the group. Through his choice of clothes, he tells members of the group that he shares their attitudes, beliefs, and way of life. People who want to show their independence may wear different styles of clothing from that worn by others. By wearing such clothes, they seem to say, "Look at me. I am someone special."

Communication. People communicate by means of the clothes they wear, just as they communicate by speaking or writing. A person's clothes may tell others who he is, what he is like, how he feels, and what he would like to be.

Who People Are. People can identify a well-known person, such as the President of the United States or a famous actor, without looking at his clothes. But few individuals are so well known. Most people glance at a person's clothes to help them identify him.

Clothing may reveal such facts as a person's occupation, approximate age, and sex. Bus drivers, mailmen, nurses, policemen, and priests wear special clothing to help other people know what they do. People of different ages usually dress differently, and men and boys dress differently from women and girls. Some types of dress or uniforms show that a person belongs to a certain group. For example, Boy Scouts and Girl Scouts wear special uniforms.

What People Are Like. Clothes tell something about a person's beliefs and feelings, his personality, and his general approach to life. A confident person usually shows greater independence in choosing his style of

Barbara Van Cleve

Cub Scouts and Cubmasters Wear Special Uniforms that identify them to other people. The kind of clothing a person wears tells something about that person.

dress than does someone who is shy or unsure of himself. The confident individual is likely to try new clothing styles. A shy person may seek security by following current styles. Others may be unconcerned about their dress and care little whether they dress in what others consider attractive clothing.

Some persons wear plain clothes because of strong beliefs about personal behavior. They believe it is wrong to care about wearing clothes as decoration and that, instead, people should be concerned with other matters. Members of the Amish religious group have this kind of belief. Amish men wear plain, dark clothes, and Amish women wear long, plain dresses. See AMISH (picture).

How People Feel. Clothing often helps communicate the mood of a person. Someone who is sad or upset may show little concern for his appearance. Clothing with bright colors and bold designs may indicate happiness. Such clothing may even brighten the mood of others who see a person wearing it.

In many societies, clothing of certain colors has special meaning. For example, people in mourning may wear black clothes. But colors may have different meanings in various societies. A color worn for weddings in one country may be worn for funerals in another land. Most brides in the United States wear white gowns. But the people of India wear white clothes to mourn the dead.

What People Want to Be. People often wear clothes that they think make them appear a certain way. An individual may dress to hide his feelings or his age, or he may dress like people in some occupation. A person who feels sad may wear bright clothes to hide his mood from others. Many children enjoy wearing the clothes of their mother or father to "play grown-up." A person entering show business may dress like a successful entertainer whom he wants to imitate. When applying for jobs, many people dress to appear older or younger than their real age. They may also dress as they think people holding a certain job should look.

Decoration. Most people want to wear clothing that makes them feel attractive—even if its chief purpose is protection or communication. Such protective clothes as raincoats, snow boots, and sweaters come in bright colors and bold patterns. Many women wear expensive furs more for beauty than for warmth. Even military uniforms are designed to improve the appearance of servicemen and servicewomen.

Many people accept frequent changes in clothing styles because they want to appear attractive by wearing the latest fashions. A woman may stop wearing an old coat that is still in excellent condition. She does so because she feels it no longer makes her so attractive as does a new style of coat.

Jack Fields, Photo Researchers

A Ceremonial Costume is probably worn more as decoration than as covering by this man in New Guinea. Decoration is one of the chief reasons most people wear clothing.

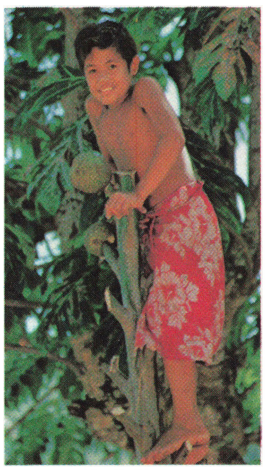
For thousands of years, people in different parts of the world have worn different types of clothes. Today, the Western style of clothing—common in the United States, Canada, and Europe—has spread throughout the world. But the clothing worn by different peoples still varies widely, especially among people who do not live in cities.

Why Clothing Varies. There are four main reasons for worldwide variety in clothing: (1) differences in the purposes for wearing clothes, (2) differences in the materials available for making clothes, (3) differences in ways of making clothes, and (4) differences in clothing customs. These differences result in clothing variety from continent to continent, from country to country, and even from person to person.

Purpose. As we have seen, people wear clothes for three basic purposes—protection, communication, and decoration. But people in various regions of the world often need different kinds of protection, especially if they live in different climates. People may also wear clothes that have a special meaning not understood by people of other countries. For example, many Moslem women wear veils in public because their religion requires them to hide their faces from strangers. In addition, people have different ideas about what makes clothing attractive.

Different Purposes for Wearing Clothes cause much of the worldwide variety in clothing styles. People wear clothes for various kinds of protection. They also wear clothes to communicate with other people and to decorate themselves. The pictures below show examples of clothing worn for protection in different climates. The pictures on the following page show examples of garments worn in various countries for different occupations, for communication, and for decoration.

Clothing in Hot and Cold Climates



David Moore, Black Star

Boy in American Samoa

Berko, DPI

Old Man in Mexico

Marc & Evelyne Bernheim, Rapho Guillumette

Berber Men in Morocco

Paolo Koch, Rapho Guillumette

Russian Family in Moscow

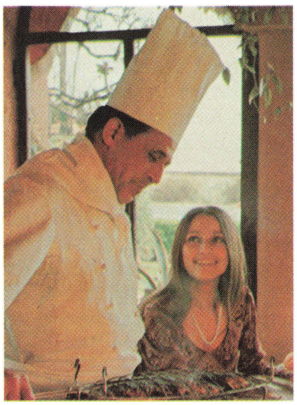
George Holton, Photo Researchers

Lapp Family in Finland

Horst Ebersberg, Rapho Guillumette

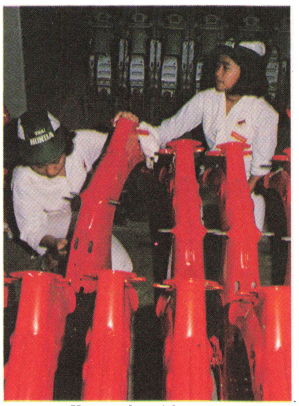
Skiers in Austria

Clothing for Work



Sabine Weiss, Rapho Guillumette

Chef in France



Van Bucher, Photo Researchers

Factory Workers in Thailand

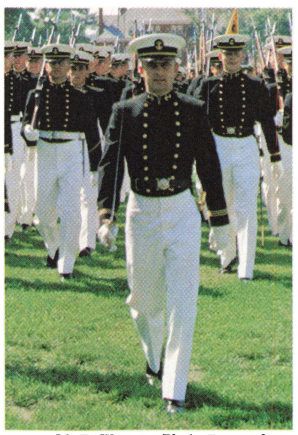
Carl Frank, Photo Researchers

Gaucho in Argentina

Clothing for Communication

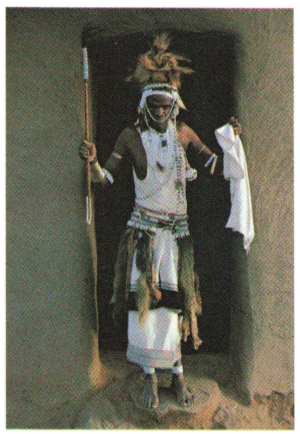
M. E. Warren, Photo Researchers

Nurses in the United States



M. E. Warren, Photo Researchers

Midshipmen in the U.S.



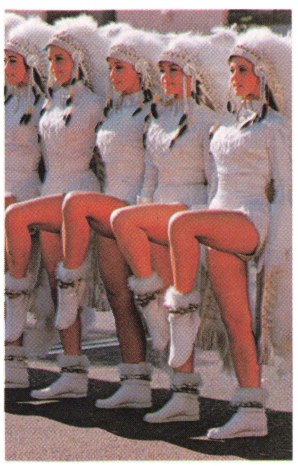
WORLD BOOK photo

Medicine Man in South Africa

Clothing for Decoration

Hermann Schlenker, Photo Researchers

Girls Dancing in Thailand



Ronny Jaques, Photo Researchers

Parade in the United States

Dennis Stock, Magnum

Geishas in Japan

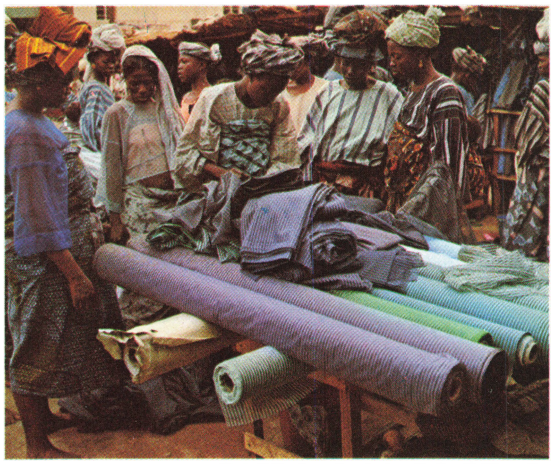
Available Materials. People in different countries may have different materials available for making clothes. For example, the people of France can wear clothes made from a much greater variety of materials than can the people of China. French stores sell garments made not only of such natural materials as cotton, fur, leather, silk, and wool, but also of such man-made fibers as nylon and rayon. Most people in China must choose clothing made of cotton.

Ways of Making Clothes vary from country to country. Highly industrialized nations—such as Canada, Japan, Russia, the United States, and West Germany—use many kinds of machines and processes to make clothes. For example, textile manufacturers in those countries can rapidly produce yards of cotton cloth woven many different ways. They can also dye the cloth bright colors and rapidly sew it into different kinds of clothes.

Someone living in a village in India may have only hand-powered equipment for weaving cloth. He may create a variety of designs—maybe more than a machine can—but he needs much more time than a machine to make the cloth. He would also have to sew his clothes by hand.

Clothing Customs affect styles. These customs develop in a country as generation after generation of children learns what clothes to wear. For example, a Mexican farmer and a Chinese farmer may wear clothes made from similar materials and by the same basic methods. They also may need their clothes for the same purpose. But the custom in Mexico is to wear straw hats with brims that tilt up. In China, custom calls for straw hats with brims that slant down.

Different Materials and Methods for Making Clothes produce differences in clothing styles. Cotton clothes, for example, look much different than clothes made of plastics. The pictures below show some of the materials and methods used in various countries for making clothes.



Marc & Evelyne Bernheim, Rapho Guillumette

Cotton Goods in Nigeria

Bruno Barbey, Magnum

Leather Clothing in Brazil

Evans

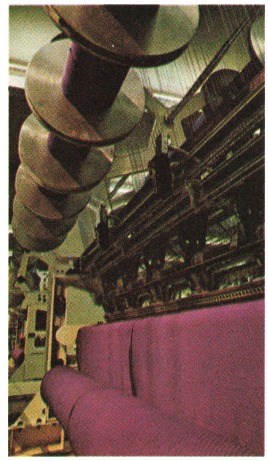
Fur Coat and Hat in the U.S.

Van Bucher, Photo Researchers

Spinning Cotton in India

G. A. Mather, DPI

Weaving Cloth in Peru



Frederick de Van from Nancy Palmer

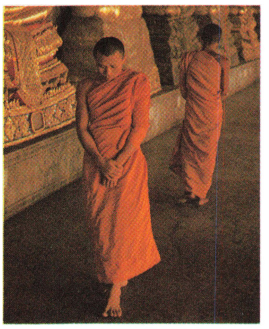
Power Loom in the U.S.

Differences in Clothing Customs result in differences in clothing styles. These customs affect the design of most kinds of clothing. But such special clothing as uniforms and ceremonial garments probably illustrate most clearly the influence of clothing customs. The photographs below show some of the types of clothing worn by religious groups and police forces in various countries.

Religious Clothing

Costa Manos, Magnum

Greek Orthodox Priests in Greece



Marc Riboud, Magnum

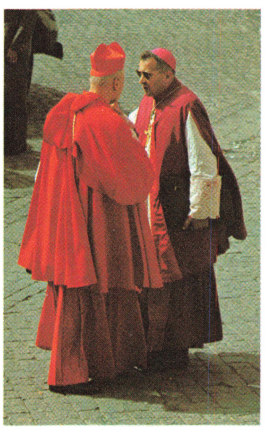
Buddhist Monks in Thailand

C. Knight, Photo Researchers

Catholic Nuns in the U.S.

John Launois, Black Star

Amish People in the United States



Elliott Erwitt, Magnum

Catholic Cardinals in Italy

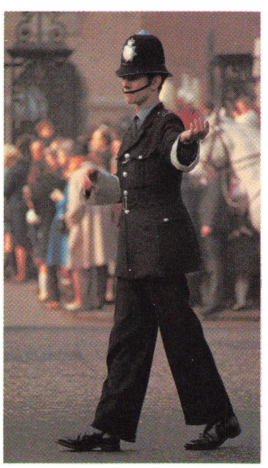
Pamela J. Meyer, Photo Researchers

Village Priest in Ghana

Police Uniforms

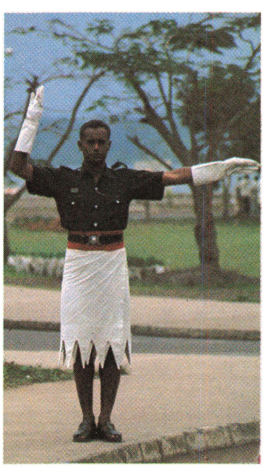
Dean Brown from Nancy Palmer

Royal Canadian Mountie



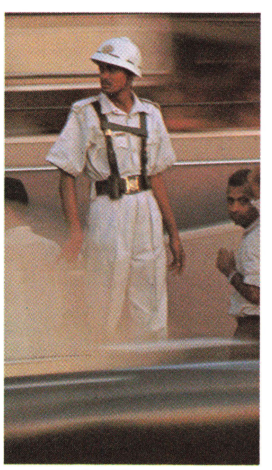
Susan McCartney, Photo Researchers

Policeman in England



Design Photographers International

Policeman in Fiji



Marilyn Silverstone, Magnum

Policeman in India

TRADITIONAL COSTUMES

Traditional costumes of many lands are shown on the following four pages. Such styles of clothing developed over hundreds of years. Many of the costumes shown are no longer worn, or are worn only as part of celebrations during festivals and holidays. This is especially true of the European costumes shown. Many of the costumes on the first two pages are still worn as everyday dress, particularly in rural areas. Traditional costumes are often called *national costumes*. But most such costumes do not represent all the people of a nation.

All illustrations in this section created for WORLD BOOK by Bill Randall and Carl Link.

Africa and the Middle East

Morocco Senegal Ghana

Kenya Somalia Syria Israel South Africa

Egypt Zaire Ethiopia Nigeria Saudi Arabia

Asia and the Pacific Islands

China

Mongolia

Burma

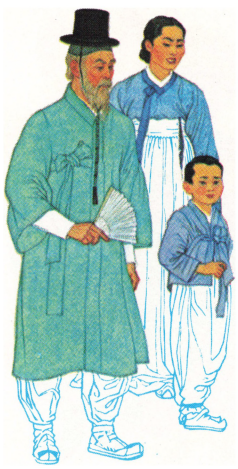
India

Indonesia

Hawaii

Philippines

Thailand



Korea

Malaysia

Vietnam

Afghanistan

Japan

CLOTHING

Europe

Switzerland Germany Austria

Norway Sweden

The Netherlands

Scotland Wales

France Greece

Spain

Czechoslovakia

Russia

Hungary

North and South America

United States Eskimos

Mexico

United States Cowboy

United States Indians

Guatemala

Brazil Chile Ecuador Bolivia Argentina Peru

For thousands of years, man has worn some kind of clothing. He probably made his first clothes from the fur of animals he killed. Gradually, man learned to use other materials. He also invented tools and machines to weave cloth and sew clothing.

This section of the article covers chiefly the history of clothing in the Middle East, Europe, and North America. The people of these regions have made the greatest contribution to the development of the Western style of dress. Information about non-Western clothing appears in other WORLD BOOK articles. For example, see the INDIAN, AMERICAN, article to learn about the clothing of North and South American Indians. See the AFRICA and ASIA articles for information about clothing worn on those continents. Also see such country articles as ARGENTINA and JAPAN to learn about the clothing worn by the peoples of those countries.

Ancient Times began about 5,000 years ago and lasted until about the A.D. 400's. Most of our information about ancient clothing comes from vases, statues, and *frescoes* (wall paintings). Much jewelry has survived from the period, but few woven fabrics or leather items have lasted through the years. Some old garments have been preserved under special conditions, such as the dry climate of Egypt.

The colors of most ancient paintings and statues have worn away through the centuries. For that reason, clothing shown on such items appears white or light-colored. Some ancient peoples—such as the Egyptians—actually wore white clothes. But many other peoples probably wore colorful garments. For example, frescoes uncovered in the 1700's at the site of the ancient Roman city of Pompeii show people wearing brightly colored clothing.

The Egyptians used linen in making most of their clothes. Many slaves and children did not wear clothes, but high-ranking families wore them to indicate their status in society. The Egyptians wore garments made of rectangular pieces of fabric.

During the early years of the ancient Egyptian civilization, men wore a wide girdle, a diaperlike *loincloth*, or a short, wrap-around skirt. Through the years, men began wearing longer skirts, and they often wore one skirt over another. Egyptian women at first wore sheath-like dresses. These tight-fitting garments had either one or two straps over the shoulders. Most of the dresses hung to the feet and left the breasts bare. The women often wore jewelry.

Later, both men and women often wore long, robe-like garments instead of skirts and dresses. They made these robes by folding rectangular pieces of cloth in half lengthwise and cutting a hole on the fold for the head. People wore the robes draped in various ways.

Wall painting from a tomb in Thebes, Egypt (1300-1090 B.C.); The Metropolitan Museum of Art, New York City

The Clothing of the Ancient Egyptians indicated their status in society. In the painting above, King Apuy and his wife, *left*, receive an offering from a priest. They all wear elaborate clothing that shows their high rank. They also wear cones of perfumed fat on their wigs.

Wooden statue from Egypt (2300's B.C.); The Brooklyn Museum, Brooklyn, N.Y., Charles Edwin Wilbour Fund

Skirts were a common type of clothing worn by many Egyptian men. Men often wore one skirt over another. The Egyptians made most of their clothes from linen.

Sometimes they let the robes hang straight and full. Other times they tied them at the waist with a wide sash.

Egyptian men and women both wore wigs made of human hair, palm-leaf fibers, or wool. Many men shaved their heads, and so did some women. Men and women occasionally wore sandals, but most Egyptians went barefoot. See EGYPT, ANCIENT (Family Life; color pictures).

The Sumerians, Babylonians, and Assyrians herded sheep and dressed in the wool their flocks provided. They lived in Mesopotamia, an area that extended through parts of what are now Iraq and Syria. The Sumerians controlled Mesopotamia first. They were followed in the area by the Babylonians and then the Assyrians.

The Sumerians wore either a smooth-fitting skirt with fringe at the bottom or a skirt called a *kaunakes*. Some historians believe the kaunakes was made of cloth covered with rows of wool fringe. Others think it was made of shaggy sheepskin. Sumerian women wore a capelike garment in addition to the kaunakes. The Assyrians and Babylonians wore chiefly a large shawl or scarf wrapped around the waist and hips. They arranged this garment with one end draped over the left shoulder. The Assyrians and some Babylonians wore a short-sleeved tunic under the shawl.

The people of Mesopotamia usually had fringe on the edges of their clothing. During the early years of this period, they wore various types of headdresses and generally went barefoot. Later, they wore sandals, shoes, and boots. Assyrian men were noted for their long, heavy, curled hair and black beards.

The Persians were among the first people to cut and fit garments, rather than simply drape themselves in pieces of fabric. Ancient Persia covered much of what is now Iran.

The Persians were hunters and horsemen. Historians believe they began to wear fitted animal skins because the fitted clothing was better suited to hunting and riding than were loose, flowing garments. Later, they made garments of woven cloth.

Persian men wore trousers that were tightly fitted at the ankles. Shoes or boots were worn with the trousers. The men also wore tunics and coats with sleeves. Persian women wore garments similar to those of the men, but they also wore long veils. Persian garments set a pattern for the fitted type of clothing that later developed in western Europe.

The Hebrews left little information about their clothing. The Old Testament provides some description of early Hebrew garments, and some paintings and carvings from the years of Assyrian and Egyptian rule show Hebrew people. These sources indicate that the

Stone statue from Sumer (about 2800 B.C.); (Raymond V. Schoder, S.J.)

The Kaunakes was a type of skirt worn by the Sumerians. Historians believe the kaunakes was made of sheepskin or of cloth covered with rows of wool fringe.

Sculpture from Iraq (800's B.C.); The Brooklyn Museum, Brooklyn, N.Y., Gift of Hagop Kevorkian (Robert S. Crandall)

The Assyrians usually put fringe on the edges of their clothing. King Assur-nasir-pal II, above, wore the style of beard and long, curled hair that was common among Assyrian men.

Wall painting from Knossos, Crete (about 1500 B.C.); (Raymond V. Schoder, S.J.)

The Cretans wore clothing styles different from those of any other ancient people. The men wore short skirts held tightly at the waist by a belt. Some of these belts may have been metal. The figure above was a priest-king of Knossos, Crete.

Hebrews dressed much like their Middle Eastern neighbors, who wore wrap-around shawls and tunics. According to the Bible, the Hebrews sewed tassels on their clothing. The men wore locks of hair called *sidelocks* on the side of the head. For religious reasons, the Hebrews avoided wearing clothing made of a mixture of linen and wool.

The Cretans lived on Crete, an island about 80 miles (130 kilometers) south of Greece. They wore clothes unlike those of any other ancient people. Cretan women wore dresses that had the tight-waisted, corseted look of Western women's dress of the mid-1800's. Skirts on the dresses were long and bell-shaped with layers of wide ruffles. The women's blouses had sleeves but left the breasts bare. The women used hair ornaments, necklaces, and other jewelry.

Cretan men wore short skirts that dipped in front and back. The skirts were held at the waist by tight belts, some of which may have been metal. Men wore boots or sandals or went barefoot. Both men and women wore various types of headdresses.

The Greeks wore soft, flowing garments made of rectangular pieces of cloth. Men and women wore the same types of clothes. Common garments included the *chiton*, a straight, hanging garment fastened at the shoulders and tied at the waist, and the *himation*, a kind of large cloak. The *chlamys* was a shorter cloak for a man that left his fighting arm bare.

Greek jewelry included gold earrings, hair decorations, and brooches called *fibulae* for fastening garments at the shoulder. The people went barefoot at home and wore boots or sandals for hunting and traveling. Men wore a broad-brimmed hat called the *petasos* and a narrow-brimmed or brimless hat called the *pilos*. Women decorated their heads with a great variety of bands, caps, and scarves. See GREECE, ANCIENT (color pictures).

The Romans wore clothing based chiefly on that of the Greeks. The Greek chiton and himation became the Roman *tunica* and *pallium* for men and the *stola* and *palla* for women. The tunica varied in length but was short for soldiers. The stola hung to the floor. It was worn over a long tunic called the *tunica talaris*, a short shirtlike garment called the *camisia*, and a tight, corsetlike band of cloth called the *strophium*. The pallium and palla were outdoor garments that the Romans could use as blankets if necessary.

Roman citizens wore a carefully draped cloak called a *toga*. The toga hung over the left shoulder and was wrapped around under the right arm. Only citizens of Rome could wear it. Slaves and exiled citizens were forbidden to wear the toga, and freed slaves needed special permission to wear it. See TOGA.

Later in the Roman period, both men and women wore a type of wide-sleeved tunic called the *dalmatica*. Boys and girls wore a locket called the *bulla* as a good luck charm. Boys wore the bulla until manhood. Girls wore it until they married. Men wore sandals, shoes, and boots. Women usually wore sandals, though they also wore shoes.

The Romans developed an enormous trade in textiles. They imported woolens from Britain and Gaul, linen from Egypt, cottons from India, and silks from China and Persia. See ROMAN EMPIRE (pictures).

Archaeological Museum, Knossos, Crete (Bernard G. Silberstein from Rapho Guilliumette)

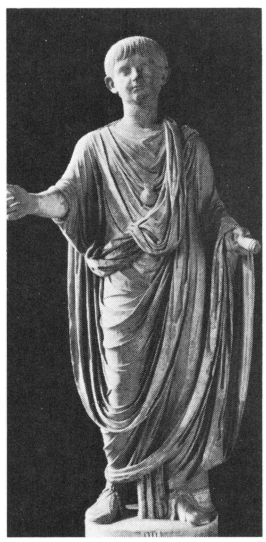
Cretan Women wore fancy dresses similar to that of the Cretan snake goddess shown above. The women also wore hair ornaments, necklaces, and other kinds of jewelry.

Sculpture from the Acropolis, Athens (about 460 B.C.) (Raymond V. Schoder, S.J.)

The Chiton, *above,* was a straight, hanging garment commonly worn by the Greeks. They often used brooches called *fibulae* to fasten the chiton at the shoulder.

Statue, *Sosandra of Calomis* (about 460 B.C.) (Raymond V. Schoder, S.J.)

Greek Men and Women both wore soft, flowing garments. The Romans had similar styles of clothing because they based their garments chiefly on those of the Greeks.



Statue (A.D. 100's); The Louvre, Paris (Giraudon)

Roman Boys wore a good luck charm called a *bulla* around the neck. They wore it until manhood. The boy shown above has on a type of cloak called a *toga*.

The Middle Ages began with the fall of the West Roman Empire in the late 400's and lasted until about the 1400's. During the Middle Ages, western Europe developed independently of what remained of the old Roman Empire, which was called the *Byzantine*, or *East Roman, Empire*.

The Byzantine Empire. The ruling classes of the empire wore highly decorated cloaks and tunics. These wealthy people used silk fabrics woven with threads of gold, and they decorated their clothes with pearls and precious stones. Poorer people wore plain tunics and blouses.

During early Byzantine times, the emperor and the men of his court wore a type of cloak called a *paludamentum* over their tunics. The empress also wore a paludamentum, and with it she wore a wide jeweled collar called a *maniakis*. Women of the court wore long stolas and pallas. In later Byzantine times, the emperor and empress wore a long, narrow scarf called a *lorum* instead of a paludamentum. Noblemen began to wear long, tight stockings called *hosa*. See BYZANTINE ART (pictures).

Western Europe. The Celtic peoples of Britain and Gaul had adopted some ideas from Roman clothing during the time of the Roman Empire. During the Middle Ages, the styles of the Byzantine Empire gradually blended with those of western Europe. Through the years, Byzantine clothing increasingly influenced the style of dress in western Europe. The ruling classes especially began to wear fancier clothes than the usual rough garments of cloth, fur, and leather.

During the early Middle Ages, people made their

Detail of a mosaic (524-547); Church of San Vitale, Ravenna, Italy (Raymond V. Schoder, S.J.)

Clothing of Early Byzantine Times included garments like those worn by the emperor and the men of his court. The picture above shows Emperor Justinian and some of his attendants.

Detail of the Bayeux Tapestry (1000's-1100's); Bayeux Museum, Bayeux, France (Giraudon)

Long, Tight Stockings were worn by many men in western Europe during the 1000's. The above picture shows King Harold II of England at his coronation in 1066. Archbishop Stigand, *right center*, proclaims Harold king. Men of Harold's court, *left*, wear cloaks over their fitted tunics.

clothes at home as they had done for hundreds of years. Families raised sheep and grew flax. They spun thread and wove it into fabric for their clothes. As towns grew, specialized shops gradually appeared, run by weavers, tailors, cobblers, and other craftsmen who made clothes. During the 1100's, these craftsmen began to organize simple labor unions called *guilds* (see GUILD). The quality of cloth improved as the craftsmen developed greater skills. They began to cut, fit, and decorate clothes in more elaborate ways.

Men and women of the early Middle Ages wore simple tunics and circular or rectangular cloaks. Later, fitted clothes began to replace the loose, flowing cloaks and tunics. The woman's tunic developed into a long dress that was laced to closely fit the upper part of her body. Men wore loose breeches under their tunics. They also wore various kinds of tight leg coverings. For example, they might wrap their legs in long pieces of cloth or wear long stockings of bright colors.

During the 1100's and 1200's, women wore metal hairnets, veils, and draped throat covers called *wimples*. Men wore hoods that had long tails called *liripipes*. Both men and women wore a type of outer tunic—adopted from the crusaders' garments—called a *surcoat*. Some surcoats were sleeveless and cut with low armholes. The woman's surcoat was long and worn over a long-sleeved gown. Men wore sleeveless surcoats of various lengths from the knee to the ankle.

During the 1300's, clothes of the upper classes became increasingly fancy, and accessories became popular. Dozens of buttons were used to trim men's outer garments. Many clothes had decorative edging called *dagging*. Men wore a close-fitting, low-waisted jacket called a *cote-hardie* with an expensive jeweled belt. A long, tight-fitting gown worn by women had the same name. In the late 1300's, both men and women wore fancy garments called *houppelandes*. At first, the man's houppelande was a long outer garment that hung to the floor. It was gradually shortened and became a jacket. The woman's houppelande was long and high-waisted with long, flaring sleeves.

In the later Middle Ages, the wealthy wore silks and other fine fabrics woven in Italy and Spain or brought to Europe from the East by traders. Lords and ladies of the courts trimmed their clothes with expensive ermine, marten, and sable fur. But most people wore linen and wool clothes. They dressed in much plainer styles than those worn by the ruling classes. The lesser nobility and the middle classes lined and trimmed their clothes with fox, otter, and rabbit fur. The common people wore garments made of the skins of goats, sheep, or wolves. See MIDDLE AGES (pictures).

Detail of an illuminated Old Testament manuscript; The Pierpont Morgan Library, New York City

The Surcoat was a tunic worn in Europe in the 1200's. These knights wear surcoats over chain-metal armor.

Detail of an illuminated manuscript, *Le Roman de la Rose;* Bibliothèque Nationale, Paris (Hubert Josse)

The Wimple was a throat cover worn by western European women during the 1200's. The women wore it with various hoodlike head coverings.

Detail of *Elderly Couple* by Jan Gossaert (about 1520); The National Gallery, London (Raymond V. Schoder, S.J.)

Fur Trim was worn on clothing during the 1400's and 1500's. Fox and rabbit fur were commonly used.

Detail of a painted chest; Accademia di Firenze, Florence, Italy (Hubert Josse)

Italian Clothing became more elaborate during the Renaissance than ever before. In this wedding scene, the two men at the far right wear a kind of draped turban called a *chaperon*.

The Renaissance began in Italy about 1300 and spread throughout Europe during the 1400's and 1500's. Towns thrived during the Renaissance, and the number of merchants and craftsmen grew rapidly. The Byzantine Empire fell, and western Europe took the lead in clothing design. European dress of the 1400's shows the influence of ideas and attitudes that developed during the Renaissance.

Clothing was fancier and more complicated than ever before. Women wore many kinds of elaborate headdresses, including the high, cone-shaped *hennin*. The hennin—worn in many European countries during the late 1400's—rose 3 to 4 feet (0.9 to 1.2 meters) high and was draped with a veil. Jewelry and bright-colored fabrics with large, flowered designs were popular.

Men wore longer stockings as jackets became shorter. The stockings became close-fitting trousers that resembled tights. Men wore many kinds of hats, including a draped turban called the *chaperon*. They also wore pointed-toe shoes called *poulaines*. On some shoes, the points measured 6 inches (15 centimeters) or more.

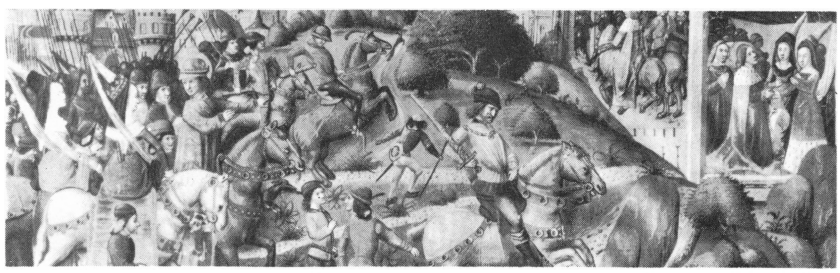
Men of the early 1500's wore many layers of outer garments, and their clothing was heavily padded. They put on linen shirts under tight-fitting upper garments called *doublets*. Over the doublet, they wore a jacket called a *jerkin*, which had a skirt that hung to between the waist and the knee. A knee-length gown with large sleeves came over the jerkin. Men also wore short, puffed breeches called *upper stocks* that were sewn to tight stockings called *netherstocks*.

Women's clothing was cut and sewn to fit tightly above the waist. During the first half of the 1500's, women wore dresses with low, square necklines and with skirts propped out stiffly over petticoats. Many skirts were split in front to show elaborate underskirts. Both men's and women's garments were often slashed so that the fabric of garments worn underneath could be pulled through in small puffs.

The stiff and formal fashions of the Spanish court influenced styles throughout Europe during the late 1500's. Men wore stockings and either padded breeches called *trunkhose* or slimmer knee breeches. Padding in the doublet developed into the *peasecod belly* fashion, which had a pointed bulge over the abdomen. The wide skirts of women's dresses were supported by a device called a *farthingale*. One type of farthingale was an underskirt with a rigid frame made of whalebone, wire, or wood. The frame made the skirt stand out stiffly away from the body. Another kind of farthingale was a long, thick pillow that women tied around the waist under a dress. Both men and women wore fancy starched collars called *ruffs*. See RENAISSANCE (pictures).

Lady with a Pink by Hans Memling; The Metropolitan Museum of Art, New York City, the Jules S. Bache Collection, 1949

The Hennin was a style of high, cone-shaped headdress worn by European women during the Renaissance.



Miniature from a manuscript of the 1400's; Bibliothèque Nationale, Paris

Renaissance Clothing included men's hats with the brim pointed in front and turned up in back. King Louis IX of France wore such a hat when he started on a crusade, as shown above.

Detail of *Portrait of Lady Guilford* by Hans Holbein the Younger; The City Museum, St. Louis (Raymond V. Schoder, S.J.)

Puffs of Fabric were often pulled through slashes in clothing during the Renaissance.

Earl of Leicester by an unknown artist; National Portrait Gallery, London

Stylish Men of the 1500's wore a *peasecod belly*, which bulged over the abdomen.

Portrait of Marchesa Doria by Anton Van Dyck; The Louvre, Paris (Raymond V. Schoder, S.J.)

The Ruff was a large starched collar worn by men and women during the Renaissance.

The 1600's. Fancy, decorated clothing remained popular throughout most of Europe during the 1600's. Spain declined in importance, and France took the lead in setting clothing styles.

Men began to replace their doublets with waistcoats worn under knee-length coats. In the mid-1600's, loose, knee-length trousers took the place of tight, padded breeches. But knee breeches came back into style by the end of the century.

Except in Spain, women began to wear many petticoats instead of farthingales under their gowns. Women also started wearing three-quarter sleeves. This startling change bared female arms for the first time since the fall of the Roman Empire more than 1,000 years earlier. With the shorter sleeves, women wore muffs and longer gloves. By the late 1600's, they were wearing *bustle* gowns. A bustle was a cushion that made a skirt stick out in back. Women also wore a type of high headdress called a *fontange*.

Men often wore high boots, and they carried a sword on a long sash that hung over the shoulder. They also wore fancy plumed hats over their long hair. Both men and women began to wear heeled shoes, many of which were trimmed with bows and buckles. Flat collars made of lace and linen gradually replaced the stiff ruff. A scarflike neckcloth, in turn, succeeded the flat collar in the late 1600's. Men began wearing huge, curled wigs called *periwigs* by about 1660.

The Puritans in England and the Puritan colonists who came to America preferred plainer versions of the clothing of the day. The women wore plain, dark-colored dresses and simple white caps. The men cut their hair short and wore high, stiff hats. They dressed in dark-colored breeches, doublets, and jerkins. Both men and women wore white collars.

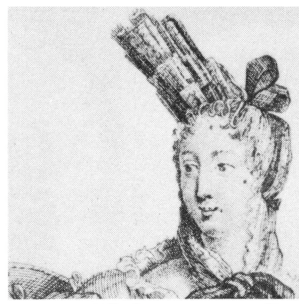
The 1700's brought many changes in the manufacture of cloth. About 1764, James Hargreaves, an English weaver, invented the *spinning jenny*, a machine that spun a number of threads at the same time. Then, between 1774 and 1779, an English weaver named Samuel Crompton developed the *spinning mule*. This machine produced as much thread as could 200 persons spinning by hand. In the mid-1780's, Edmund Cartwright, an English clergyman, developed a steam-powered loom. With such machines as these, English weavers produced large quantities of cloth at prices lower than those charged by guild craftsmen, who wove by hand. Large factories took over the production of

James Stuart, Duke of Richmond and Lennox by Anton Van Dyck; The Metropolitan Museum of Art, N.Y.C., Gift of H. G. Marquand

Clothing of the 1600's included fancy, heeled shoes. Many of these shoes were trimmed with bows. Collars of lace and linen became popular in the 1620's. Men wore knee breeches during much of the century.

Marie Thérèse of Spain, Queen of France, and the Grand Dauphin by Pierre Mignard; The Prado, Madrid (Hubert Josse)

Three-Quarter Sleeves were worn by women during the 1600's. They also wore long gloves or muffs. To make their dresses curve out widely from the waist, women wore petticoats instead of the farthingale used during the 1500's.



Detail of an engraving by N. Arnoult; The Metropolitan Museum of Art, New York City

The Fontange was a type of headdress worn by women during the late 1600's. It was fastened to the front of a cap.

Detail of *Salon of Madame Geoffrin* by an unknown French artist; National Museum of Versailles and of the Trianons, Versailles, France (Hubert Josse)

Waistcoats worn under knee-length coats became popular during the 1600's.

cloth, and many people stopped making cloth at home. See INDUSTRIAL REVOLUTION.

Clothing styles changed rapidly. But only the nobility and the wealthy could afford the new fashions. Most people still wore comfortable, long-lasting woolen clothing. Many continued to make their own fabrics and clothes.

French fashions set the clothing standards in Europe during most of the century. But late in the 1700's, the French Revolution interrupted France's fashion leadership, and England took the lead. After the revolution, France regained leadership in the design of women's clothes, but English tailoring continued to influence men's fashions. Clothing styles in England and France affected those in the United States. Many Parisian designers distributed dolls dressed in fashions to be copied in England, America, and other parts of the world.

Both men and women wore fancy hair styles. Men covered their heads with large powdered wigs of various shapes. By the 1770's, women wore their hair in high, carefully arranged styles called *pompadours*. They made their hair stiff with grease and powder and decorated it with feathers, jewels, and ribbons. They also added hairpieces to their own hair and wore wigs. Sometimes women did not comb out or re-dress their hair for several weeks because the styles were so complicated.

Women wore tight corsets and great round skirts held out by a hoop. During the 1780's, a bustle replaced the hoop. The style included very large fancy hats. Men wore variations of the coats, waistcoats, and breeches introduced during the late 1600's.

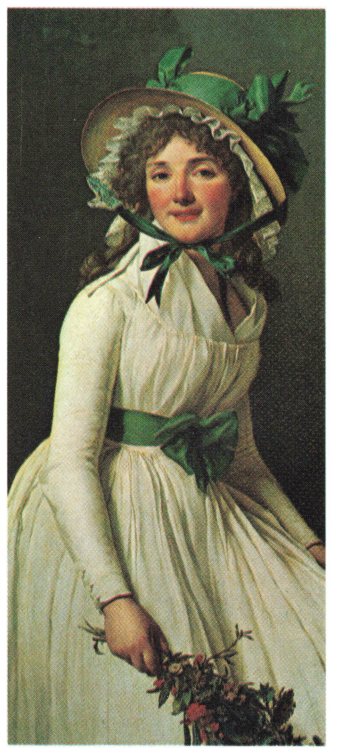
The outbreak of the French Revolution in 1789 brought great changes in clothing style in France and throughout the rest of Europe as well. Men started to wear much plainer clothes, with less color and ornamentation. They adopted top hats and hats called *bicornes*. Bicornes had brims folded up to form two points. These hats replaced the *tricorne*. The tricorne, which had the brim folded to make three points, had been popular for most of the 1700's. Women began wearing clothing that imitated the styles of ancient Greece. This clothing included sandals and lightweight cotton dresses. Women cut their hair short and curled it, and they wore wide-brimmed bonnets. Dresses had low necklines and high waistlines with drawstrings. This dress style became known first as *Directoire* and then, in the early 1800's, as *Empire*.

Detail of *Portrait of the Artist with his Wife and Daughter* by Nicolas de Largillière; The Louvre, Paris (Bulloz)

Men Began Wearing Periwigs during the 1600's. These wigs remained popular into the late 1700's. Also in the late 1600's, a scarflike neckcloth replaced the flat collar as the style among fashionable men.

Detail of *Gathering in a Park* by Louis Joseph Watteau; Cognacq-Jay Museum, Paris (Bulloz)

Large, Fancy Hats became stylish for women during the late 1700's. Women also wore tight corsets that made their waists look small in comparison to their great round skirts. During the early 1700's, women used hoops to support the skirts. The bustle later replaced the hoop.



Detail of *Portrait of Madame Serizlat* by Jacques Louis David; The Louvre, Paris (Hubert Josse)

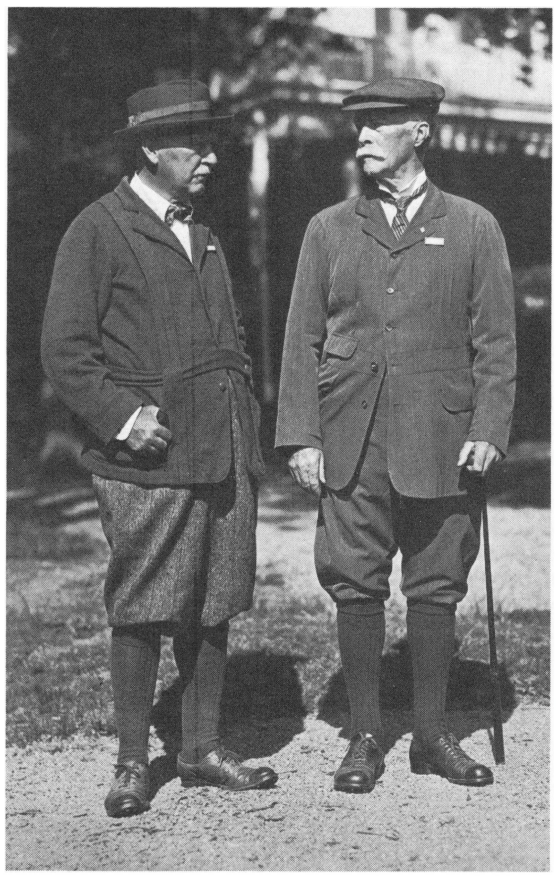
Women's Clothing became much simpler in the early 1790's during the French Revolution. Fashionable women began wearing lightweight cotton dresses. Their clothing became even plainer during the late 1790's.

The 1800's. Much production of clothing by hand ended during the 1800's, and the clothing industry became firmly established in the United States. Two Americans—the inventor Elias Howe and a machinist named Isaac Singer—developed improved sewing machines in the mid-1800's. These machines and other inventions made the manufacture of cloth and clothing easier. Manufacturers began to make inexpensive, ready-to-wear clothes. Production methods used by manufacturers gradually improved. But many people still preferred to have their clothes made by a tailor or dressmaker if they could afford it. Others continued to wear homemade garments.

The Empire style lasted until the 1820's. Tight-waisted, full-skirted gowns became popular during the 1830's and 1840's, and women wore many petticoats under them. By the 1850's, women wore stiff wire or whalebone petticoats called *crinolines* to support their skirts. Earlier types of crinolines were underskirts made partly of horsehair.

By the 1870's, full-skirted dresses gave way to bustle gowns. In the 1880's, a European designer introduced the first suits for women. A type of blouse called a *shirtwaist*—worn with a separate skirt—became fashionable in the Gay Nineties. Women wore costumes designed in an "hourglass" style and laced in their waists tightly to make them as small as possible.

In the 1800's, men's clothes continued to become plainer. By about 1815, fashionable men in Europe and the United States were wearing trousers instead of knee breeches, which had been the style for more than 200 years. For general wear in the early part of the century, men wore the long *tail coat*. Later, the knee-length, full-skirted *frock coat* replaced the tail coat. Then the plain *sack coat*, which is still worn today, replaced the frock coat. Men kept the tail coat for formal wear only. A coat called the *tuxedo* was also worn for formal occasions in the late 1800's. Men also wore caps, round



Paul Thompson, Photoworld

Knickers resembled the knee breeches worn in the 1600's and 1700's. They became popular as sportswear during the late 1800's. These men wear Norfolk jackets with their knickers.

Engraving; Library of the Carnavalet Museum, Paris (Lauros-Giraudon)

Tight-Waisted, Full-Skirted Dresses became popular during the 1830's. Women wore many petticoats under their skirts.

Engraving; Carnavalet Museum, Paris (Lauros-Giraudon)

Fashionable Men of the 1800's wore the frock coat, *left*, and the tail coat, *center and right*. They also wore top hats.

Bettmann Archive

The Hourglass Style was worn by women in the 1890's. This style called for waists laced in as tightly as possible.

bowler hats, high top hats, and straw hats. *Knickers*, which resembled the old knee breeches, became popular for sports after 1870.

In the 1800's, most workers in the clothing industry earned low wages for working long hours—often more than 12 hours a day. They were crowded together in dimly lighted, poorly ventilated workrooms. As a result of the generally poor working conditions, these rooms became known as *sweatshops*. In the early 1900's, state legislatures began to pass laws that eliminated most sweatshops. See SWEATSHOP.

The 1900's. From 1890 to 1920, improved manufacturing methods brought rapid growth to United States companies that made ready-to-wear clothing. Both men and women began to wear mostly clothing that was *mass-produced* in factories (see MASS PRODUCTION). As a result of mass production, women's fashions could change more rapidly than ever before. But men's clothing styles changed little until the 1960's.

In the 1900's, women began to wear looser, lighter-weight clothing. The changing styles—especially in leisure and sports clothes—gradually uncovered different parts of women's bodies. Legs were bared in the 1920's, abdomens in the 1940's, and thighs in the 1960's. Today, women wear less clothing than in any other period since ancient times.

For a few years around 1910, women wore *hobble skirts*. These skirts were so tight at the bottom that a woman could hardly walk. Clothing became simpler and less formal during World War I (1914-1918). In the 1920's, women adopted the "boyish" look. Dresses were straight and unfitted, and they ended at, or a little above, the knee. In the 1930's, some women began wearing slacks. Skirts became longer during the 1930's and then shorter during the early 1940's. During World War II (1939-1945), women wore many tailored styles with padded shoulders. Slacks—worn by women working in war industries—also became popular.

Women's fashions changed greatly after World War II. Crinolines and long, full skirts returned. Nylon garments, including stockings and *lingerie* (underwear), became available in large quantities for the first time. During the 1950's, straight, tight-fitting *sheath dresses* and shorter hemlines gained popularity. *A-line dresses* and loose-fitting *shifts* came into style during the early 1960's. The very short *miniskirt* quickly spread to other countries following its appearance in England in the mid-1960's.

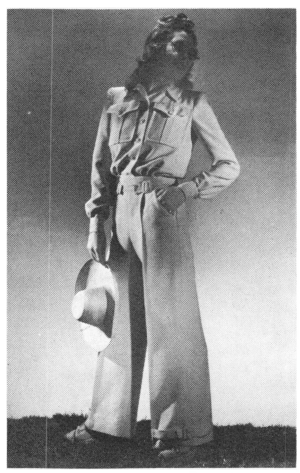
From 1900 to 1950, both single-breasted and double-breasted men's suits were popular. Shoulders were *natural* (unpadded) about 1910 but gradually became more padded. During the 1950's, many men switched to single-breasted *Ivy League* suits, which had narrow lapels and natural shoulders. They also began wearing colored shirts with business suits.

Both men and women developed great fondness for sportswear and wash-and-wear fabrics during the 1950's and 1960's. Leisure and sports clothes for women included knee-length Bermuda shorts, tapered slacks, and ski and stretch pants. Men wore Bermuda shorts, slacks, and colorful sport shirts. Improvements in sewing machines and in dress patterns brought an increased interest in sewing.

In the 1960's, many young men started to wear colorful fashions, many of which included fancy jewelry. They also grew beards and mustaches. During the early 1970's, men of all ages joined in the change to colorful clothes. They began wearing shirts in checks, stripes, and many colors with business suits. They also wore wide ties in fancy prints, stripes, or bright swirling colors. Men of all ages began growing beards and mustaches. They also began wearing their hair longer than in the 1960's. Women's fashions included skirts of every length—from the miniskirt to the *maxiskirt*, which fell to the ankle. Many people seemed to have an "anything goes" feeling toward clothing styles.

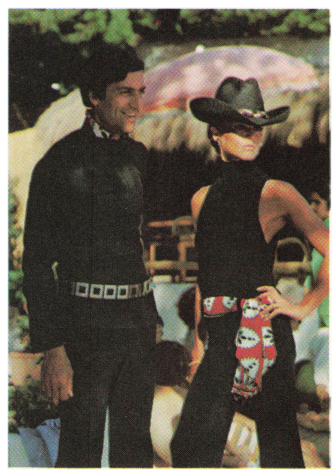
Photo Researchers

The Boyish Look was fashionable during the 1920's. Women wore straight, unfitted dresses that hung to about the knee. They also wore long necklaces. Skirts became longer during the 1930's.



Photoworld

Pants Outfits were worn by women during the 1940's. Fashionable women generally wore tailored styles with padded shoulders.



Slim Aarons, Photo Researchers

Many Clothing Styles became popular during the early 1970's. Fashions changed rapidly, and men and women often wore similar styles.

The clothing industry is one of the largest industries in the world. It includes the manufacture of women's, children's, and infants' clothes and men's and boys' wear. The industry also produces furs; embroidery; hats, jewelry, shoes, and other accessories; items called *findings* (buttons, hooks and eyes, snaps, zippers, and thread); underwear and sleepwear; foundation garments; and sportswear.

The main clothing centers of the world are London, New York City, Paris, and Rome. The United States leads all countries in the manufacture of clothing, and Russia ranks second. The U.S. clothing industry is the nation's ninth largest industry. There are more than 26,000 U.S. clothing manufacturers, and they employ about $1\frac{1}{3}$ million persons. About 10,500 of these companies make women's clothes. The Canadian clothing industry has about 2,300 manufacturers.

The largest number of garment factories in the United States is in the Middle Atlantic States—New York, New Jersey, and Pennsylvania. New York leads all the states, with about 11,000 clothing manufacturers. New York City ranks as the chief clothing manufacturing center of the United States, followed by Los Angeles-Long Beach; Philadelphia; Chicago; Jersey City, N.J.; and Boston.

Most clothing manufacturers have small factories. These firms employ an average of fewer than 100 persons, though some have as many as 1,000 workers.

Clothing Materials include a variety of natural and man-made substances. Man has used some materials, such as animal furs, for clothes for thousands of years. Other materials, including plastic sheetings and man-made fibers, came into practical use during the 1900's.

Natural Materials include fur, leather, and cloth that is made of plant or animal fibers.

Fur and leather provide many of the warmest and longest-wearing clothes. They are also used in some of the most expensive, fragile, and luxurious garments. Fur comes only from warm-blooded animals. Leather is obtained from either warm- or cold-blooded animals.

Fur is used mostly for coats and coat linings. Such furs as *mouton*, a fur made of sheepskin, make warm coats that wear well. Chinchilla fur is soft, fragile, and not so warm as other furs. Most furs are dyed, plucked, sheared, or treated in some other way before being made into clothes. See FUR.

Most leather is used to make shoes. Such items as gloves and handbags—and some jackets, pants, skirts, and suits—are also made of leather. Tanners manufacture leather by treating hides to make them soft and flexible and to prevent them from rotting. Most leather for clothing is made from cowhide. See LEATHER.

Cotton, flax, silk, and wool are the natural fibers most widely used in clothing. They are long and flexible and can easily be made into thread. Cloth made from each of these fibers has a special quality that makes it popular. Silk has great luster and softness, for example, and wool provides warmth.

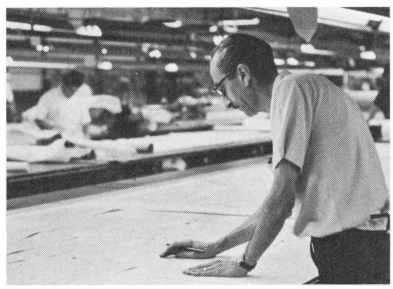
Threads of cotton, flax, silk, and wool fibers are usually knitted or woven into fabric (see KNITTING; WEAVING). Such methods as braiding and lace making are occasionally used to make clothing materials. Wool can be made into felt by pressing and rubbing together warm, damp wool fibers. Other kinds of fibers do not stick together when pressed unless they have been treated with an adhesive substance.

STEPS IN THE MANUFACTURE OF CLOTHING

The manufacture of ready-to-wear clothing begins when designers create new styles. The process ends with the distribution of clothes to stores. The pictures on these two pages show some important steps in the manufacture of clothing.

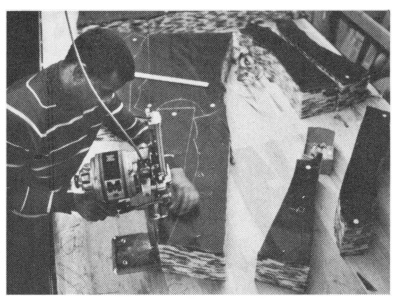
Ronald A. Sherman from Nancy Palmer

A Buyer for a Store Decides to Order a New Style of Coat.



Genesco

A Marker Outlines a Pattern on Material.



Ronald A. Sherman from Nancy Palmer

A Worker Cuts Material for Garments.

Cotton fibers come from the *boll* (seed pod) of the cotton plant. Fibers from the stem of the flax plant are woven into linen. Silk, the strongest of all natural fibers, comes from cocoons spun by silkworms. Sheep provide most of the wool used by man, though such animals as the alpaca and various breeds of goats also furnish wool. See COTTON; LINEN; SILK; WOOL.

Man-Made Materials include paper, plastic sheetings, rubber, and man-made fibers. Clothing manufacturers are using more and more of these materials because they have certain advantages over natural ones. For example, many man-made fibers are stronger, more shrink-resistant, or less expensive than natural fibers.

In 1884, a French chemist and inventor named Hilaire Chardonnet patented the first successful man-made fiber. He called it *artificial silk*. Chardonnet's fiber was first manufactured in the United States in 1910. It was named *rayon* in 1924. Since then, scientists have developed many other man-made fibers called *synthetics*. Synthetics, unlike rayon, are made by combining two or more chemical substances. Examples of synthetics include nylon and polyester.

Today, many widely used fabrics are blends of natural and man-made fibers. For example, such fabrics could be a mixture of cotton and polyester or wool and nylon. These fabrics have the characteristics of each fiber used in the blend. A fabric made of wool and nylon is warm because of the wool and is shrink-resistant because of the nylon. See SYNTHETICS with its list of *Related Articles*.

Paper, plastic sheetings, and rubber have been used less in clothes than have man-made fibers, but their use is increasing. Some paperlike fabrics are made of fibers held together by adhesive substances. Others are made by combining synthetic fibers with natural fibers or rayon. The synthetics melt when heated and hold the network of fibers together as a fabric. Such fabrics are widely used in making disposable diapers, which are thrown away after being soiled once. Paperlike fabrics are also used for other disposable garments, including bibs, underwear, and rainwear. Manufacturers use plastic sheetings in making such products as handbags, raincoats, and shoes. Rubber is used chiefly to make such flexible, long-lasting, waterproof clothing as boots and gloves.

Ready-to-Wear Clothes. Most clothes worn today are ready-to-wear garments. Mass production of clothing saves customers both the time it would take to make clothes themselves and the money they would spend on clothes made by a dressmaker or tailor.

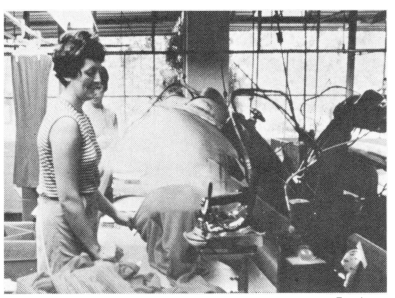
Designing is the first step in the manufacture of ready-to-wear clothing. Fashion designers in London, New York City, Paris, and Rome create most clothing styles. They work under great pressure to produce designs—especially of women's fashions—that people will want to buy.

In the United States, most large clothing manufacturers employ their own designers. These experts create styles in addition to those that come from Paris and the other fashion centers. Manufacturers try to sell the designs to buyers from clothing stores. Most smaller clothing manufacturers purchase designs from independent designers, as do firms that produce garments which change little in fashion.

After a designer has an idea for a style, he chooses the colors and types of fabrics in which to make the

Jantzen

Workers Sew Pieces of Material.



Jantzen

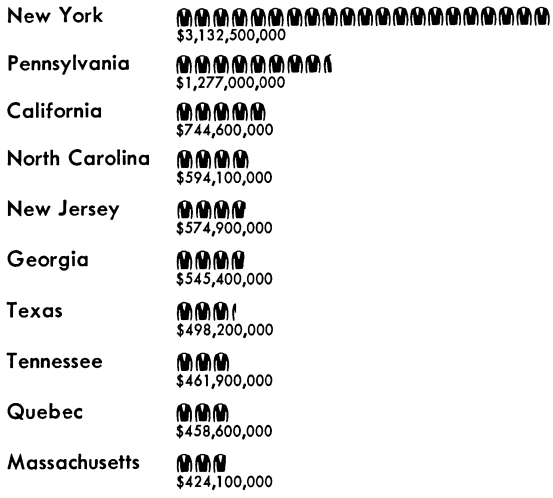
A Presser Irons a Finished Garment.

WORLD BOOK photo

A Mother and Her Children Go Shopping for New Coats.

LEADING CLOTHING-MANUFACTURING STATES AND PROVINCES

Value added by manufacture in 1971



Sources: U.S. Bureau of the Census; Statistics Canada

garment. He then makes samples of the garments, and buyers from stores come to see them. If a buyer sees a style he thinks will be popular, he orders garments of that design.

The final test for any style comes when the clothes appear in stores. If enough people buy a particular style, stores will reorder it from the manufacturer. If customers ignore a style, it soon disappears—and another style takes its place.

Manufacturing and Selling. After receiving orders from stores for a certain design, the manufacturer cuts patterns of the garment in various sizes. Ready-to-wear clothes come in standard sizes for different ages and figure types.

Clothing manufacturers buy fabrics in large rolls called *bolts.* Expert examiners unroll the bolts of material and inspect them for rips or other flaws. *Spreaders* pile them on large tables. Workers called *markers* outline each pattern in chalk on the material. In some companies, the markers transfer pattern markings to a large piece of paper that serves as a guide for cutting the material. Next, *cutters* use electric cutting machines or hand cutting tools to cut out the various parts of the garments. Then *sorters,* who also are called *assemblers* or *bundlers,* number the pieces. These employees put all the pieces for one garment in a bundle, along with the necessary buttons and trimmings. The bundles are then sent to the sewing room.

Most sewers handle only one or two parts of a garment. For example, a sewer may stitch only shoulder seams and hems. Another may make pockets and collars. On some elaborate, expensive coats, dresses, or suits, one person may do all or most of the sewing by hand. *Finishers* do all the outside stitching, such as making buttonholes. *Pressers* iron the completed garments.

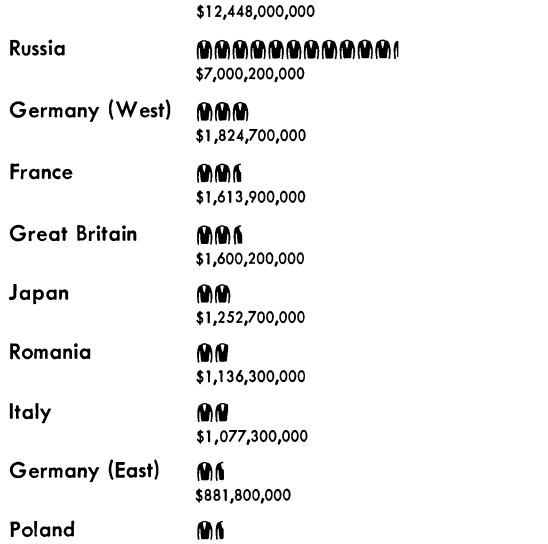
Some clothing companies handle all the steps in the manufacture and distribution of their products. Others send their cut garments to clothing *contractors,* who sew them together and return them to the manufacturer. Sometimes clothing *jobbers* buy cut garments and complete the manufacturing and distribution process. Manufacturers sell most garments directly to retail stores. They may also sell to wholesale dealers, who in turn sell to retailers.

Protecting the Public. In the United States, federal laws protect the public in the purchase of clothing. Several of these laws require clothing manufacturers, wholesalers, and retailers to cooperate with textile manufacturers in placing accurate labels on all garments.

The Wool Products Labeling Act of 1939 requires labels on wool fabrics to tell the kind and amount of wool used. If wool fiber from a garment that has been worn is shredded up and made into yarn or fabric, manufacturers must label the new product *reused.* If the wool has been made into a fabric before but not used in a garment that was actually worn, manufacturers must say the wool has been *reprocessed.* The Textile Fiber Products Identification Act of 1958 calls for labels that show fiber content by percentage. This law applies to all fabrics except those made of wool. The Fur Products Labeling Act of 1952 requires labeling of fur garments and accessories. These labels must identify the type of animal fur and tell if it has been bleached or dyed. The Flammable Fabrics Act of 1953 prohibits the sale of fabrics that burn easily.

LEADING CLOTHING-MANUFACTURING COUNTRIES

Value added by manufacture in 1971



Based on International Standard Industrial Classification, which includes footwear.

Sources: U.S. Bureau of the Census; Statistical Office of the UN

People choose their clothes for a variety of reasons. They may have personal preferences in styles, or they may want to follow fashion changes. Usually, people consider the purpose for which they need clothing. For example, people need different clothes for protection in different climates. They may also need different clothes for different activities, such as working or attending school. As a result, no rules for choosing clothes apply to everyone. But most people want to wear clothes that, according to custom, are considered (1) attractive and (2) appropriate. This section describes some clothing customs of Western nations and provides information on how to care for clothes.

Attractive Clothing. Most people think it is attractive to have a slender figure. They also feel that men and boys look most attractive with broad shoulders and slim hips. Customs concerning the appearance of women and girls change frequently. But people usually think that women and girls look best with smaller waists than hips and hips somewhat smaller than shoulders.

People who want to follow custom can use clothing to change the appearance of their figures. They can choose clothes that hide their figures or that draw attention away from parts of the body they do not want people to notice.

Loose-fitting garments, such as shifts and straight coats, hide body size and shape For example, a girl's flared skirt that stands out from her body will show waist size while hiding the hips. Straight garments that hang to the feet not only cover body shape, but they also direct attention upward, emphasizing height. In men's suits, shoulder pads make hips seem narrow in comparison to the wide shoulders.

Lines and colors used in clothes can also help change body appearance. In general, vertical stripes draw attention to height. Horizontal stripes emphasize width. A small light-colored area can draw attention away from a large dark-colored area. For instance, a light-colored shirt worn with a dark suit draws attention to a man's face and away from the rest of his body.

The above guidelines apply in most cases. But to make certain a garment creates the desired effect, a person should try it on.

Appropriate Clothing. Clothing customs for most activities permit a person to select his clothes from a wide variety of styles. But most people believe they should wear clean, well-kept clothing—whatever the style—in school, at work, or in other places where they associate closely with other people.

A person can spend a small amount of money and still have appropriate clothes for many different activities. If you want a small, inexpensive wardrobe, you may wish to consider the following suggestions: (1) Choose clothing appropriate for many different activities. (2) Choose clothes that you think will remain in fashion for more than a year. (3) Buy washable clothes rather than those that require dry cleaning. (4) Choose clothes guaranteed by the manufacturer not to shrink or fade.

Daily Care helps clothing last longer and keep its original appearance. Removing stains from clothes immediately may keep the stains from setting. The WORLD BOOK article on DRY CLEANING includes a table of some common stains and how to remove them.

WORLD BOOK photo courtesy Bobbie Brooks

Taking Care of Clothing helps it last longer and preserves its original appearance. Brushing removes loose dirt from clothes. Putting clothes on hangers keeps the garments from wrinkling.

Wrinkles often disappear from clothes if the garments are put on hangers between wearings. In addition, garments stretched by wear may return to their original shape if allowed to hang for a few days. Sweaters and many other knit garments keep their shape better when folded than when hung.

When pressing clothes, use the iron temperatures that may be recommended on garment labels. Modern electric irons have dials that indicate the proper settings for different fibers. Federal laws require that manufacturers tell the fiber content of garments on labels.

Cleaning. Garments made of different fabrics may require different kinds of cleaning. Most clothes made of cotton and of man-made fibers may be laundered. Most garments made of wool require dry cleaning. Garments made with blends of fibers may usually be cleaned by the method appropriate for the fiber present in the greatest percentage.

Some linings and trim require a different cleaning method than that used for the rest of the garment. The manufacturer may tell on the garment label how to clean the garment.

Storing. Most clothes not worn for long periods of time can be kept in good condition if they are cleaned and then stored in airtight bags. Cleaning removes stains that may become permanent. Airtight storage keeps clothing clean and helps prevent moth damage. Mothproofing chemicals may also be sprayed on garments.

Fashion Designers hold important positions in the clothing industry. The sale of a garment depends largely on the popularity of its design. In turn, the jobs of many people and the profits of many companies depend on the work of designers. Persons who wish to become fashion designers may take fashion-designing courses in college or attend special design schools in New York City or some other large city.

A successful fashion designer may have special personal qualifications or talents. In addition, most designers know how to drape and sketch new styles, draw and cut patterns, and sew garments. Many designers start their careers as assistants in design departments, as sample makers, or as artists in pattern houses. In time, some designers establish their own firms or form partnerships with other designers.

Fashion Coordinators perform a variety of jobs. For example, they may plan an entire fashion show or select the shoes that a model wears for an advertisement. Most large department stores employ fashion coordinators who select merchandise, plan displays, and promote sales. For such work, a person must have a thorough knowledge of current fashion trends.

Fashion Writers and Artists specialize in describing or illustrating clothes for advertisements and articles in magazines and newspapers and for direct-mail ads. They may work for advertising agencies, department stores, manufacturers, publications, or wholesalers. Experts called *copywriters* prepare the written material for clothing advertisements. They must have a talent for writing and a knowledge of clothing design and materials. Fashion editors decide what current fashions will appear in their publications. They may travel to Paris or other fashion centers to attend fashion shows. These editors must know what types of displays will catch a reader's attention, and they should be able to forecast fashion trends.

Fashion illustrators need some knowledge of clothing construction in addition to a talent for drawing. Fashion photographers must know how to work with fashion models and arrange merchandise attractively as well as how to use camera equipment.

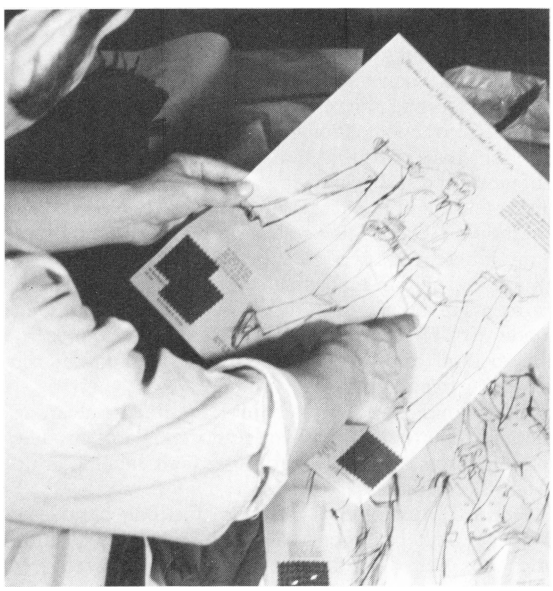
Garment Manufacturing. Men and women who are interested in making clothes may become cutters, dressmakers, finishers, sewing-machine operators, or tailors. They must be able to work quickly and skillfully with their hands. Most garment makers start in training positions under experienced workers. Persons with training in business management or industrial engineering may find opportunities in garment-manufacturing plants as production managers or plant engineers.

Merchandising. Qualified persons may find positions with stores as buyers, department heads, or salesmen. In time, they could become officers in a store or chain of stores. Many men and women open their own small retail clothing shops.

A number of colleges and business schools offer specialized management courses that provide training for merchandising positions. Most large department stores offer management-training programs to college graduates and occasionally to experienced members of their staffs.

Teaching. Men and women with enough college training may qualify to teach high school or college courses related to clothing. Teaching specialties include clothing design, the history of clothing, the merchandising of clothes, and the meaning and importance of clothing in society.

MARY ELLEN ROACH



Genesco

A Fashion Designer creates clothing styles. In addition to drawing sketches of a new style, the designer chooses the colors and types of fabric to be used in making the garment.

Bruce Davidson, Magnum

Dressmakers Learn Their Trade by working with plastic figures called *mannequins*. By using a mannequin, a dressmaker can adjust a garment to fit the shape of the human body.

Related Articles. See the sections of the many country articles in WORLD BOOK in which clothing is discussed, such as JAPAN (Way of Life). See also the following articles:

ARTICLES OF CLOTHING

Derby
Fez
Glove
Handkerchief
Hat
Helmet
Moccasin
Necktie
Parka
Shoe
Stockings
Turban
Uniform

CLOTHES MAKING AND CARE

Amalgamated Clothing Workers of America
Dressmaking
Dry Cleaning
Dyes and Dyeing
Fashion
Garment Workers' Union, International Ladies'
Knitting
Laundry
Sewing
Spinning
Textile
Weaving

CLOTHING MATERIALS

Acrilan
Batiste
Broadcloth
Brocade
Buckram
Calico
Camel's Hair Cloth
Canvas
Cashmere
Chambray
Chenille
Chiffon
Corduroy
Cotton
Covert
Crepe
Crinoline
Dacron
Damask
Denim
Dimity
Drill
Duck
Duvetyn
Dynel
Faille
Felt
Flannel
Foulard
Gabardine
Gingham
Grosgrain
Haircloth
Jersey Cloth
Kersey
Khaki
Lace
Leather
Linen
Lisle
Madras
Mohair
Moiré
Muslin
Nainsook
Nylon
Organdy
Orlon
Percale
Piqué
Poplin
Rayon
Satin
Serge
Shantung
Shoddy
Silk
Swiss
Synthetics
Taffeta
Terry Cloth
Tulle
Tweed
Velour
Velvet
Velveteen
Voile
Wool
Worsted

CLOTHING IN HISTORY

Armor
Colonial Life in America (Clothing; pictures)
Egypt, Ancient (Family Life; color pictures)
Gauntlet
Greece, Ancient (Family Life; color pictures)
Indian, American (Clothing; pictures)
Pioneer Life in America (Clothing)
Prehistoric Man (How Prehistoric Hunters Lived)
Renaissance (pictures)
Roman Empire (Family Life)
Toga
Tunic
Western Frontier Life (Clothing)

OTHER RELATED ARTICLES

Arab (Clothing)
Batik
Button
Culture (pictures)
Embroidery
Eskimo (Clothing; pictures)
Fiber
Flax
Grooming, Personal (The Importance of Clothing)
Hairdressing
Health (Clothing)
Jacquard
Jewelry
Lace
Modeling
Needle
Pin
Sewing Machine
Tartan
Thread
Twill
Zipper

Outline

I. Why People Wear Clothes
A. Protection
B. Communication
C. Decoration
II. Clothing Around the World
A. Why Clothing Varies
B. Traditional Costumes
III. Clothing Through the Ages
IV. The Clothing Industry
A. Clothing Materials
B. Ready-to-Wear Clothes
C. Protecting the Public
V. Choosing and Caring for Clothing
A. Attractive Clothing
B. Appropriate Clothing
C. Daily Care
D. Cleaning
E. Storing
VI. Career Opportunities

Questions

What are the three main reasons for wearing clothes?

What improvements did the *spinning jenny* and the *spinning mule* bring to the manufacture of cloth?

What are some ways in which federal laws protect the U.S. public in the purchase of clothing?

What advantages do man-made fibers have over natural ones?

When did man learn to make yarn and weave cloth?

How do customs influence clothing styles?

What cities rank as the world's chief clothing centers?

Who were among the first peoples to wear fitted clothes?

Why does clothing vary in different parts of the world?

How can clothes change the appearance of a person's figure?

Books to Read

CUMMINGS, RICHARD. *101 Costumes for All Ages, All Occasions.* McKay, 1970.

GAWNE, ELEANOR J., and OERKE, B. V. *Dress: The Clothing Textbook.* 3rd ed. Bennett, 1969.

HEAD, EDITH, and HYAMS, JOE. *How to Dress for Success.* Random House, 1967.

JUPO, FRANK J. *Nothing to Wear but Clothes.* Dutton, 1953.

LEEMING, JOSEPH. *The Costume Book.* Lippincott, 1938.

LESTER, KATHERINE M., and KERR, R. N. *Historic Costume: A Résumé of Style and Fashion from Remote Times to the 1960's.* Rev. ed. Bennett, 1967.

LISTER, MARGOT. *Costume: An Illustrated Survey from Ancient Times to the 20th Century.* Plays, 1968. *Costumes of Everyday Life: An Illustrated History of Working Clothes.* 1972.

SEVERN, WILLIAM. *If the Shoe Fits.* McKay, 1964. *Hand in Glove.* 1965.

WILCOX, R. TURNER. *Five Centuries of American Costume.* Scribner, 1963. *Folk and Festival Costume of the World.* 1965.

CLOTHING WORKERS OF AMERICA, AMALGAMATED. See AMALGAMATED CLOTHING WORKERS OF AMERICA.

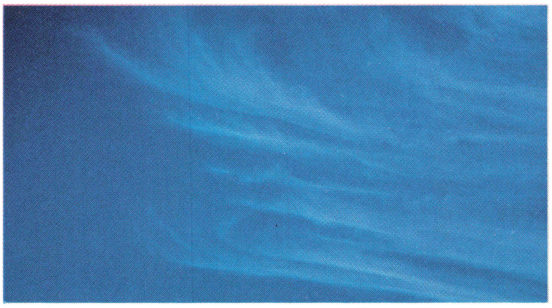
CLOTHO. See FATES.

CLOTURE, or CLOSURE, shuts off debate in a legislative body. A legislature may vote to effect cloture. Free and open debate is necessary in a democracy in order to reach sound decisions and protect minority groups. But if debate is unlimited, a minority in a legislature may prevent any action simply by continuing to debate. The U.S. Senate adopted a cloture rule in 1917, and amended it in 1959 and 1975. The Senate requires a vote of at least 60 senators, three-fifths of its members, to achieve cloture on most issues. On proposed changes in Senate rules, however, cloture requires a vote of two-thirds of the senators present and voting. See also FILIBUSTERING.

EDWARD W. CLEARY

Peter Black, Tom Stack and Associates

A Towering Cumulus Cloud may rise to great heights and may develop into a cumulonimbus cloud that brings a thunderstorm.

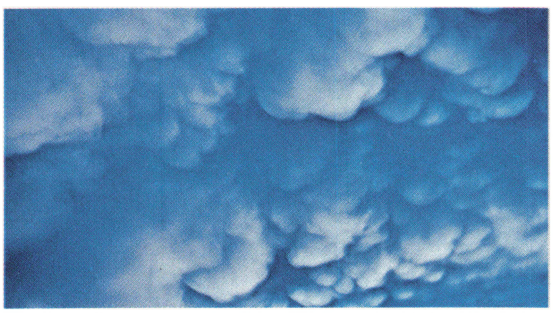


Van Bucher, Photo Researchers

High Cirrus Clouds look like tufts of hair. They are so high and cold that the water they contain is frozen into ice crystals.

Van Bucher, Photo Researchers

Medium-High Altocumulus Clouds, above, may appear as small cloud patches arranged in bands or irregular groups.



Bernie Mendoza, Tom Stack and Associates

Some Cumulonimbus Clouds have rounded bumps on their undersides. Tornadoes sometimes come from these clouds.

Russ Kinne, Photo Researchers

Low Stratus Clouds cover the sky with a thick, even blanket. These clouds usually bring rain or snow.

CLOUD is a mass of small water droplets or tiny ice crystals that floats in the air. Fluffy white clouds floating across a blue sky, or the colors of clouds at sunset, are part of the beauty of nature. Clouds also play an important part in the earth's weather. The water that they bring as rain and snow is necessary to all forms of life. Clouds can also bring destruction or even death, in the form of hail or tornadoes.

Some clouds are great fleecy masses, and others look like giant feathers. Still others are dull gray or black sheets that darken the earth. Most clouds change shape continually. They do so because parts of the cloud evaporate when touched by air that is warmer than the cloud. Cloud shapes also change because of the action of winds and air movements.

Reid A. Bryson, the contributor of this article, is Professor of Meteorology and Geography at the University of Wisconsin.

Kinds of Clouds

The name of a cloud may describe its appearance. For example, the term *strato* means *layerlike* or *sheetlike*. Clouds that appear as layers or sheets are called *stratus* clouds. The term *cumulo* means *pile* or *heap*, and *cumulus* clouds are piled-up masses of white clouds. The term *cirro* means *curl*, and *cirrus* clouds are curly white clouds. The term *nimbo* means rain, and *nimbus* clouds are dark gray rain clouds. These terms and a few others are used to form the names of the most common

Josef Muench

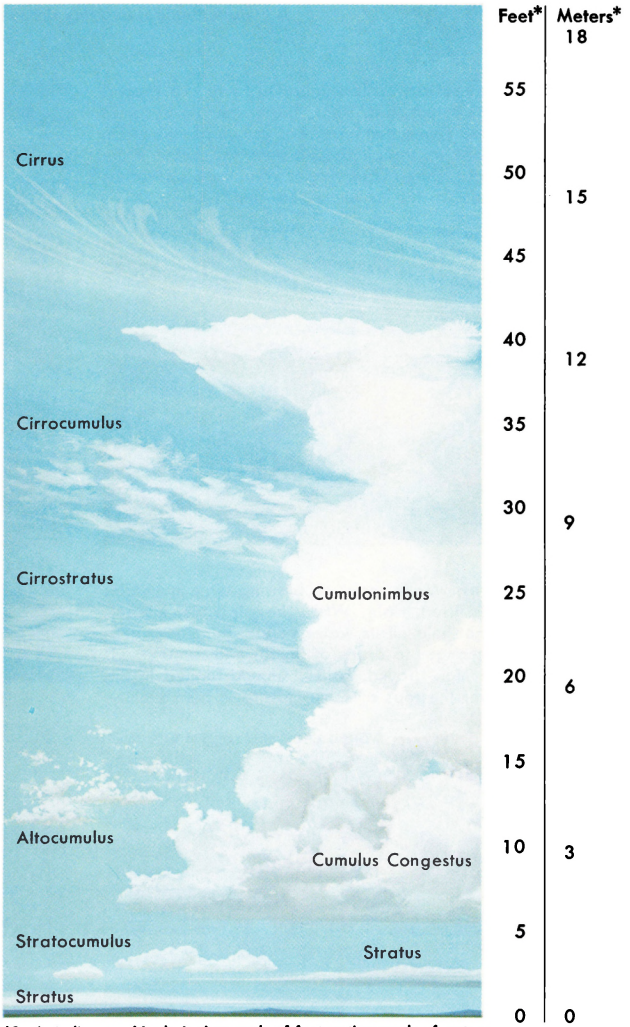
Cirrus Fibratus and Cirrus Floccus Clouds are thicker than the wispy cirrus clouds, and cover larger areas of the sky.

Ray Brod

Altocumulus Undulatus Clouds, *above,* appear in bands across the sky. The gaps between the bands may be wide or narrow.

Russ Kinne, Photo Researchers

Stratocumulus Clouds cover the sky with large, rounded masses within a few thousand feet of the ground.



*Scale indicates altitude in thousands of feet or thousands of meters.

WORLD BOOK diagram by Herb Herrick

Different Clouds Are Seen at Various Altitudes above the earth. This diagram shows examples of some common clouds and their approximate altitudes. Many clouds are found only within a certain range of altitudes. Other clouds, such as the cumulonimbus, extend from very low to very high altitudes.

clouds. Clouds are grouped into classes according to their height above the ground.

Low Clouds. Two kinds of clouds, *stratus* and *stratocumulus*, are usually seen near the earth. The *bases* (lower edges) of most of these clouds are less than 6,000 feet (1,800 meters) above sea level. A stratus cloud looks like a smooth, even sheet. Drizzle often falls from it. A stratocumulus cloud is not as even in thickness as a stratus cloud. It has light and dark areas on the bottom, indicating, as its name suggests, that there are piles of clouds in the layer.

Middle Clouds, called *altostratus*, *altocumulus*, and *nimbostratus*, usually lie from 6,000 to 20,000 feet (1,800 to 6,100 meters) above the earth. Nimbostratus clouds sometimes may be closer to the ground. An altostratus cloud forms a smooth white or gray sheet across the sky. If the cloud is not too thick the sun may be seen through it. An altocumulus cloud appears in many shapes. It may be seen as unconnected piles or as a layer of clouds piled together. A nimbostratus cloud is a smooth layer of gray. Frequently, the cloud itself cannot be seen because of the rain or snow that is falling from it.

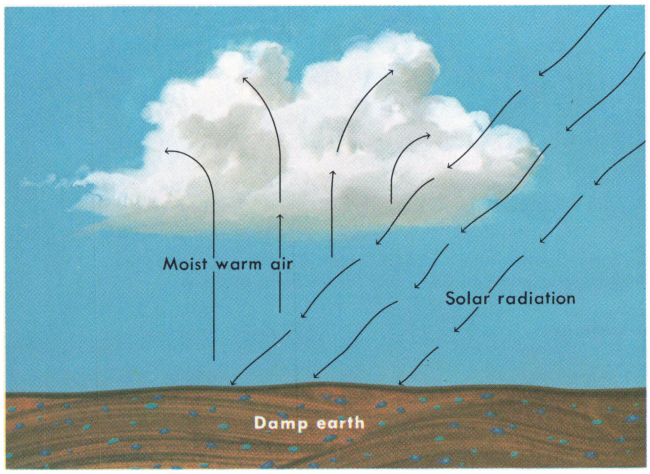
High Clouds, called *cirrus*, *cirrostratus*, and *cirrocumulus*, are formed entirely of ice crystals. Other clouds are mainly water droplets. Cirrus clouds are the delicate wispy clouds that appear high in the sky, sometimes higher than 35,000 feet (10,700 meters). A cirrostratus cloud is a thin sheet of cloud. It causes a halo to appear around the sun or moon. This halo is the

HOW CLOUDS FORM

Clouds form when moist air rises and becomes cooler. The air usually rises by (1) convection, (2) lifting, or (3) frontal activity. Cool air cannot hold so much water vapor as warm air can, and the excess vapor changes into tiny drops of water or crystals of ice. These drops or crystals form clouds.

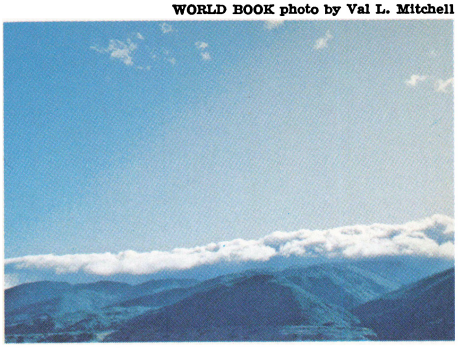
By Convection. Solar radiation heats the ground and the air next to it, *right*. The warm air becomes lighter and *convection* (a flow of air) carries this warm air upward. As the air rises, it becomes cooler. If the air is moist, some water vapor condenses and forms clouds, such as the cumulus clouds shown below.

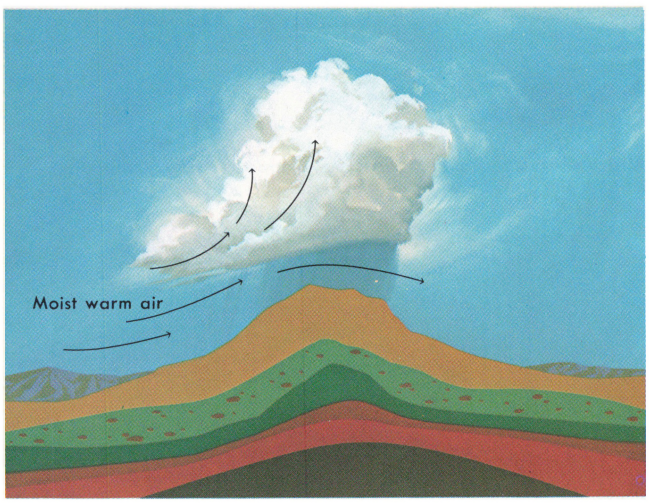
Ray Atkeson



By Lifting. Warm, moist air blowing over mountains or hills is lifted, *right*. When the air rises, it cools and cannot hold all its water vapor. This vapor *condenses* (changes to drops of liquid) and forms clouds over the high ground, *below*. Clouds formed in this way cover the tops of some mountains permanently.

WORLD BOOK photo by Val L. Mitchell

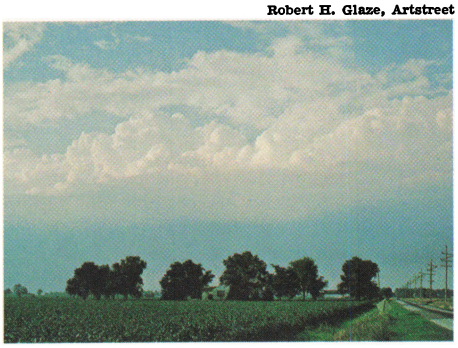


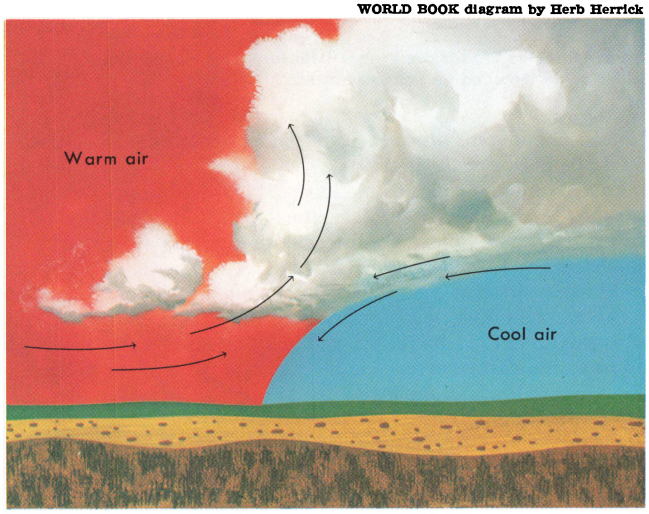


WORLD BOOK diagram by Herb Herrick

By Frontal Activity. A weather front occurs when two masses of air at different temperatures come together. The diagram, *right*, shows cool air moving under warm air along a cold front. The warm air is cooled as it rises above the cool air. Many clouds form, *below*, along the front at all altitudes.

Robert H. Glaze, Artstreet





best way to recognize a cirrostratus cloud. Cirrocumulus clouds look like many small tufts of cotton hanging high in the sky. These clouds rarely form.

Clouds at More Than One Height. *Cumulus* and *cumulonimbus* clouds may rise to great heights while their bases are near the ground. Cumulus clouds are heaped-up piles of cloud. They may float lazily across the sky or change into the most spectacular of all clouds, the cumulonimbus. A cumulonimbus cloud may reach heights as great as 60,000 feet (18,000 meters) from its base. Its top of cirrus clouds spreads out in the shape of an anvil. This kind of cloud is often called a *thunderhead* because heavy rain, lightning, and thunder come from it. Sometimes hail or, on rare occasions, a deadly tornado comes from a cumulonimbus cloud.

How Clouds Form

Clouds form from water that has evaporated from lakes, oceans, and rivers, or from moist soil and plants. This evaporated water, called *water vapor*, expands and cools as it rises into the air. Air can hold only a certain amount of water vapor at any given temperature. When the temperature drops, some of the water vapor begins to *condense* (change to a liquid) into tiny droplets of water.

For water vapor to condense, particles so small they can be seen only through a microscope must be present. These particles, called *condensation nuclei*, become the centers of the droplets. Many condensation nuclei are tiny salt particles or small particles present in smoke. Most droplets measure from $\frac{1}{2,500}$ to $\frac{1}{250}$ inch (0.01 to 0.1 millimeter) in diameter.

If the temperature is cold enough, and other conditions are right, water vapor does not condense and form a liquid droplet. Instead, the water vapor turns directly to ice through a process called *sublimation*. For sublimation to occur at temperatures above −40° F. (−40° C), small particles similar to condensation nuclei, with a shape somewhat like an ice crystal, must be present. These particles are called *freezing nuclei*.

A cloud often contains both water droplets and ice particles if the temperature is between 32° and −40° F. (0° and −40° C). Water droplets do not always freeze at the normal freezing temperature of water, 32° F. They may remain liquid down to a temperature of −40° F.

Rain or snow forms when water evaporates from the liquid droplets and freezes on an ice crystal. The crystal grows larger until it falls out of the cloud. It falls to earth as a snowflake unless it enters a layer of air where the temperature is above freezing. Then the snowflake melts and becomes a raindrop.

Water vapor can rise to form clouds in several ways. When the sun warms the ground, the air next to the ground is heated. Because warm air is lighter than the same volume of cooler air, the warm air rises. This rise of warm air is called a *convection current*, and this method of cloud formation is called *convection*. As the air rises, it expands and becomes cooler. If enough water vapor is in the expanding air, the vapor will condense and form clouds.

Clouds also form by *lifting*. When warm, moist air moves up the side of a hill or over a mountain range, it is lifted and cools by expansion. This cooling causes the water vapor to condense and form clouds that hang over the mountains.

Weather fronts, where masses of warm and cool air meet, produce clouds by *frontal activity*. The water vapor in the rising warm air becomes cooler and condenses, creating the water droplets that form clouds.

Clouds and the Weather

Storms. Weather forecasters study clouds carefully because certain types often appear before storms. In many cases, a warm front or a low pressure system may be identified by these clouds, which form in a definite order over several days. First, a few wispy cirrus clouds appear in the west. Soon more appear and gradually merge into cirrostratus clouds that cover the sky. The cirrostratus clouds are later hidden by a lower layer of altostratus clouds that becomes thicker and hides the sun. Light rain or snow may begin to fall from the altostratus layer. The base of the clouds becomes still lower as nimbostratus clouds move in with heavier rain or snow. Cumulus and cumulonimbus clouds often develop within the nimbostratus ones, and the steady rain becomes a heavy shower.

As the storm moves past, the rain or snow ends but the sky remains overcast with stratocumulus clouds. These low clouds disappear as soon as fair weather returns.

A cold front brings clouds in a different order. Often, both middle and high clouds come before the front. The most striking feature of most cold fronts is a wall of large cumulus or cumulonimbus clouds along the advancing edge of cold air. As this wall passes overhead, the temperature falls. Heavy showers may also occur, and the direction of the wind usually shifts from the south to the northwest. After the line of clouds passes, many cumulus or stratocumulus clouds may remain for a short time. Clearing weather then occurs rapidly.

In summer, it is often possible to watch a thunderstorm form. The sky may be clear in the morning, or a few altocumulus clouds might be present. As the earth becomes warmer, small cumulus clouds appear and begin to grow. These clouds may become large, towering cumulus clouds that bring a little rain. As the towering cumulus clouds continue to grow, an anvil of cirrus clouds spreads out at the top and extends ahead of the main clouds. The clouds are now cumulonimbus, and a thunderstorm usually follows.

Heating and Cooling of the earth are also influenced by clouds. Most cloudy days are cooler than clear days because the clouds reflect much sunlight back into space. This reflected sunlight does not heat the earth. On the other hand, clouds have an opposite influence on the earth's temperature at night. The earth gives off heat toward space, causing the ground to cool off. Clouds intercept much of this heat and send it back toward the ground. For this reason, most cloudy nights are warmer than clear nights. The heat is trapped in the lower layer of air between the cloud and the ground. Therefore, low clouds trap much more heat than do higher clouds.

REID A. BRYSON

Related Articles in WORLD BOOK include:

Cloudburst	Rain	Water (color picture: The Water Cycle)
Fog	Rain Making	
Lightning		Weather

CLOUD CHAMBER is a device for tracing the paths of atomic particles. See WILSON CLOUD CHAMBER.

CLOUD SEEDING. See RAINMAKING.

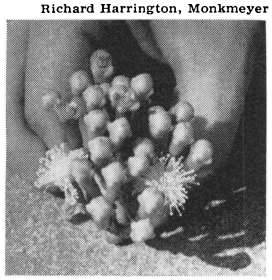
CLOUDBURST is a sudden heavy rain falling for a short period of time in a small area. Cloudbursts are usually associated with thunderstorms. They occur most often in desert and mountain regions, and in the interiors of continents, such as the Great Plains of the United States. The uprushing air currents of a thunderstorm support a large amount of water in the form of raindrops. If the air currents are suddenly cut off, the mass of rain quickly falls out over a small area. Stream beds become torrents, and rivers form in valleys that are usually dry. During a cloudburst, more than 1 inch (2.5 centimeters) of rain may fall in 15 minutes. See also CLOUD; RAIN; WEATHER. JAMES E. MILLER

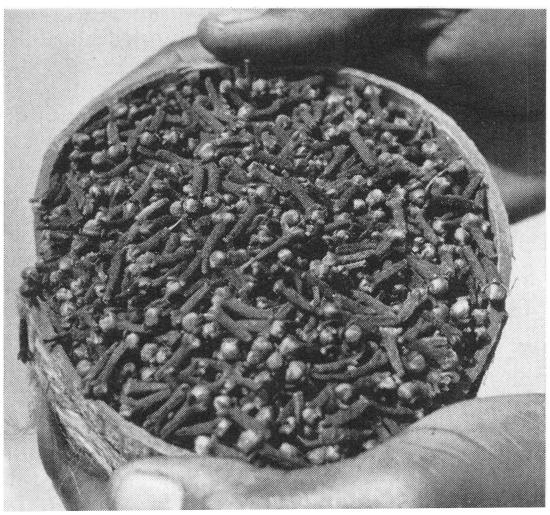
CLOVE is the name given to the dried flower buds of a tropical tree. The dried buds are used as spices. The name comes from the French word for *nail* because of the shape of the flower bud. The clove tree grows wild in parts of Indonesia and the West Indies. Clove trees are also grown as a crop in Indonesia, the Malagasy Republic, and Tanzania.

The clove tree, an evergreen, grows 15 to 30 feet (4.6 to 9 meters) tall. The large, smooth, oblong leaves taper to a point. The tree's purplish flowers grow on jointed stalks. The buds of these flowers, called *cloves*, are picked before they open. They are reddish when picked, but turn dark brown when dried. Cloves have a fragrant odor and a warm, sharp taste. They are used chiefly in cooking. An oil taken from the buds and stem of the clove tree is used to flavor desserts and candies, and to scent soaps.

Scientific Classification. The clove tree belongs to the myrtle family, *Myrtaceae*. It is classified as genus *Caryophyllus*, species *C. aromaticus*. HAROLD NORMAN MOLDENKE

Richard Harrington, Monkmeyer





Cloves are the unopened flower buds of a tropical tree. The reddish buds grow on jointed stalks, *right*. When the buds are dried, *below*, they are dark brown and look like little nails. Dried cloves, used as a spice, have a warm, sharp taste.

St. Clair

Sweet Clover Has Small White or Yellow Flowers.

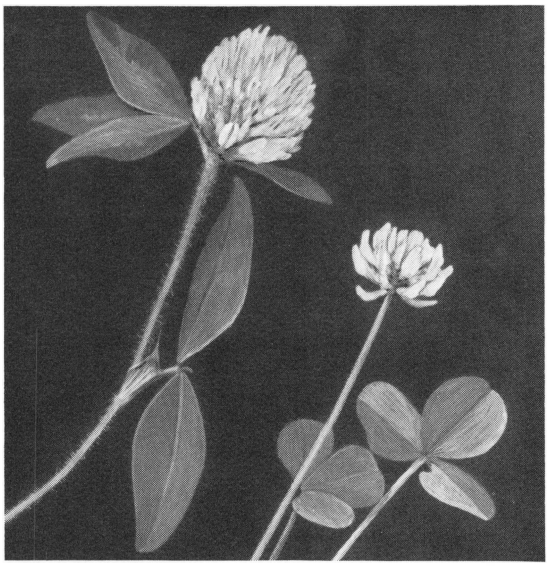
CLOVER is the name of several different kinds of legumes that grow wild in fields, on lawns, and along roadsides. Several kinds of clover are cultivated as food for livestock. Clover plants usually have three leaves, but sometimes more. Superstitious people believe that four-leaf clovers bring luck, and that five- and six-leaf clovers bring evil.

Most clover plants grow in the Northern Temperate Zone, although some are also found in South Africa and South America. They grow successfully in lowlands and also high up in the mountains. About 300 different kinds of clover plant are known.

Red Clover is the most important of all clovers. It is a weak perennial, which means it lives two or more years but is not long-lived. It grows from 6 inches to 2 feet (15 to 61 centimeters) tall. Farmers grow red clover to make hay, to provide pasture for farm animals, and to enrich the soil. This plant fixes nitrogen in the air by means of bacteria growing on its roots. When the plant is plowed under, this nitrogen makes the soil richer. About five times as much red clover as alfalfa is grown in the United States to feed livestock. Red clover flowers usually will not be fertilized unless a bumblebee pollinates them. When red clover was first planted in Australia, there were no bumblebees to carry the pollen. Not until bumblebees were introduced into the country would the red clover produce seed.

White Clover is a valuable pasture crop. Bees make expensive honey from the nectar in white clover blossoms. White clover is seldom grown alone. It is usually mixed with grasses and with other clovers. White clover, also a perennial, does not grow tall. Its stems creep along the surface of the ground and send down roots. For this reason, white clover spreads rapidly and provides an especially valuable plant for pastures and in lawns.

Alsike Clover is often called *Swedish clover*. It came to the United States from Sweden by way of England. It grows well in a cool, moist climate and reaches a height of 1 to 3 feet (30 to 91 centimeters). The flowers range from white to pink.



St. Clair

Blossoms and Leaves of Red, *left,* and White Clover

Crimson Clover is much used for soil improvement and for livestock feed. Its flowers are often red, but sometimes may be white or yellow. Crimson clover must be planted from seed every year. It has often been called scarlet, or Italian, clover.

Other Kinds of clover include hop clover, rabbit-foot clover, Ladino clover, Japan clover, which is best-known as lespedeza, mammoth red clover, medicago, and strawberry clover.

Sweet Clover is not a true clover, although it is a legume. Sweet-clover plants are tall, erect plants somewhat like alfalfa in appearance. Four important kinds of sweet clover grow in the United States. White and yellow sweet clovers, which live for two years, are widely grown in the southern states. Their large roots penetrate deep into the soil. At the end of the second season, they decay and enrich the soil with nitrogen and decaying vegetable material. One kind of white sweet clover grows only for one year. Sour clover, a kind of sweet clover used almost entirely to improve the soil, is often called melilot.

Scientific Classification. Clover plants are in the pea family, *Leguminosae.* Red clover is genus *Trifolium,* species *T. pratense.* White clover is *T. repens;* alsike, *T. hybridum;* and crimson, *T. incarnatum.* White sweet clover is genus *Melilotus,* species *M. alba.* Yellow sweet clover is *M. officinalis;* sour clover, *M. indica.* ROY G. WIGGANS

See also BUMBLEBEE; FLOWER (color picture: Flowers of Roadside, Field, and Prairie); LEGUME; LESPEDEZA; SHAMROCK.

CLOVERLEAF. See ROADS AND HIGHWAYS (Intersections).

CLOVIS I, *KLOH vihs* (466?-511), a Frankish king, became the first powerful ruler of the Merovingian dynasty, the founders of the French state. In 481, when Clovis inherited the royal title, he was only one of several Frankish kings. Then, in 486, he defeated the last great Roman army in Gaul. In one campaign after another, he defeated the Alamanni, the Visigoths, and the Burgundians. By 507 he ruled over most of Gaul, western Germany, and the Low Countries of northwestern Europe.

Clovis was the first Germanic king to become an orthodox Christian. Most Germanic rulers either became Arian heretics or remained pagans. By his conversion to Christianity, Clovis won the support of his Catholic subjects, including the clergy. WILLIAM C. BARK

See also FLEUR-DE-LIS; FRANK; GOTH; MEROVINGIAN; SALIC LAW.

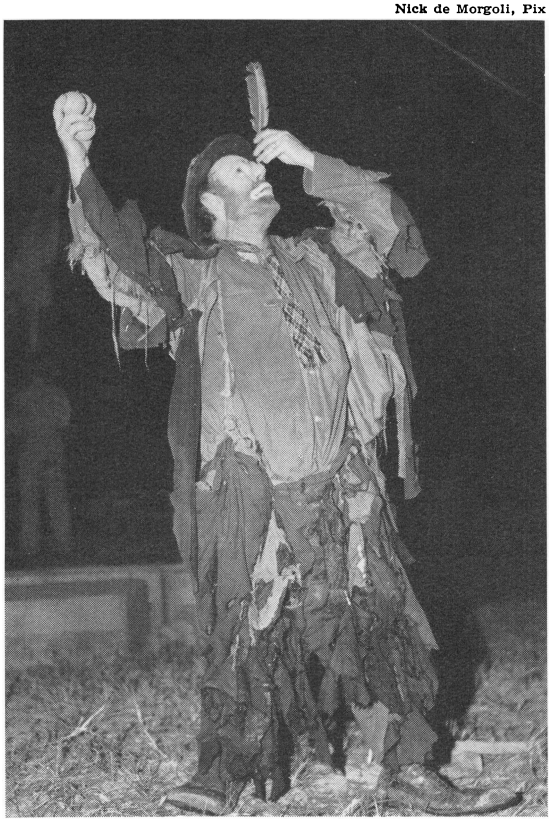
CLOWN is a comedian or buffoon in a circus. His make-up and costume are his own personal trademark, and no other clown may dress or make up in exactly the same way. The present-day circus clown had his prototype in the court jester of the Middle Ages. Clowns in early American circuses were talking and singing comedians. When circuses expanded their arenas to three rings, clowns were relegated to straight pantomime. In this role they reached their peak as comics.

American circuses feature clowns principally as punctuation points in their swift-paced shows. The clowns serve as comic relief between the tense performances of the aerialists, acrobats, equestrians, and trained animals. Many clowns have their own acts as comic, but expert, aerialists and bareback riders. Many clowns perform on either high or low wires.

Famous American clowns include Dan Rice, a talking and singing clown in the late 1800's. He numbered

Clown Emmett Kelly became famous as a sad-faced hobo who wandered quietly around the circus ring in tattered suit and hat.

Nick de Morgoli, Pix



President Abraham Lincoln among his fans and personal friends. Fred Stone, Bobby Clark, and Paul McCullough were circus clowns before they became stage comedians. Their success on the stage is often credited to their ability to get laughs in straight pantomime. Lou Jacobs, Paul Jung, and Felix Adler made up as *white-face* clowns. Otto Griebling adopted a hobo type, and Emmett Kelly became famous for his sad-faced tramp. Clowns in other countries include the Fratellinis, the Great Grock, Popoff the Russian, Robbins the banana clown, and Polidor. Long ago, P. T. Barnum, the great American promoter, remarked on the importance of clowns when he said that "Clowns are pegs used to hang circuses on." F. B. KELLEY

See also CIRCUS.

C.L.U. See INSURANCE (Careers).

CLUB is a group of persons organized for some particular purpose, such as social enjoyment and entertainment. A club is usually confined to one community, but there are many state and national groups. Membership is usually by invitation.

People join clubs for a number of reasons. Sometimes they merely believe in or favor the purposes of the club and wish to help support it. Sometimes they want fellowship. Some people value exclusiveness in a club, and are happy to become members of a group which seldom invites other people to join. Many people join clubs formed to celebrate a common experience, such as servicemen joining veterans' groups.

Modern clubs in England and the United States grew out of informal gatherings in the English taverns of the 1500's and 1600's. Groups of literary men and actors, along with the wealthy men who supported them, often met to talk and exchange views. One of the early London clubs met in the Mermaid Tavern in Cheapside. Among its members were Shakespeare, Ben Jonson, Beaumont, Fletcher, and Donne. Jonson established the Apollo Club at the Devil Tavern in 1624, and drew up bylaws for it. In 1764, Dr. Samuel Johnson and Sir Joshua Reynolds founded a club that still exists. It is called the Literary Club or simply The Club, and its first members included such distinguished figures as David Garrick, Edmund Burke, and Oliver Goldsmith.

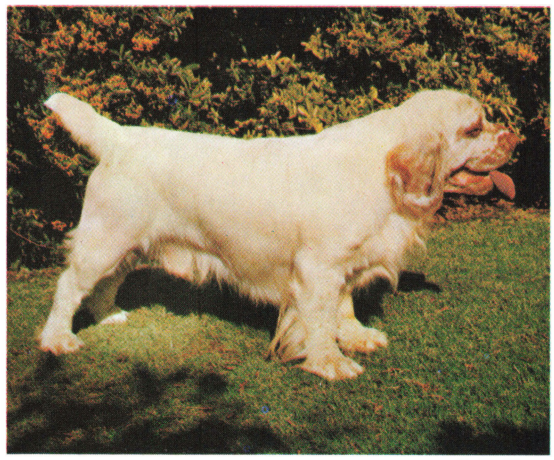
Related Articles. Clubs and organizations are listed in WORLD BOOK under the key word in the name of the group. Example: LIONS CLUBS, INTERNATIONAL ASSOCIATION OF. See also PARLIAMENTARY PROCEDURE; SERVICE CLUB; WOMAN'S CLUB.

CLUB MOSS is any one of a group of plants related to the ferns and horsetails. Club mosses are also called *ground pine*, or by the scientific name, *Lycopodium*. The plants are not true mosses. Club moss has a long rootstock that grows horizontally in the soil and produces erect green stems. The stems bear branches that divide and spread like a fan. The branches are covered with small green leaves that look like those of spruce or cedar. One to three cones develop at the tops of the branches. These cones contain spores for reproduction.

Scientific Classification. Club mosses are in the club moss family, *Lycopodiaceae*. They are all classified in the genus *Lycopodium*. ROLLA M. TRYON

See also FERN; HORSETAIL.

CLUBFOOT, or TALIPES, is an abnormal condition of the foot, usually present at birth. But it may develop later as the result of injury or poliomyelitis or other diseases. In the true clubfoot, the foot is bent downward and inward so that the person can walk only on his toes or on the outside of his foot. Sometimes the foot is bent in an upward and outward position so the person can use only his heel for walking. Doctors begin treatment early, sometimes when the baby is only a week old. They use massage, manipulate the foot into position, and use casts to hold the corrected position. In severe cases of clubfoot, surgery may be necessary to correct the condition. CLAUDE LAMBERT



R. W. Meyer

The Clumber Spaniel Has a Low, Heavy Body.

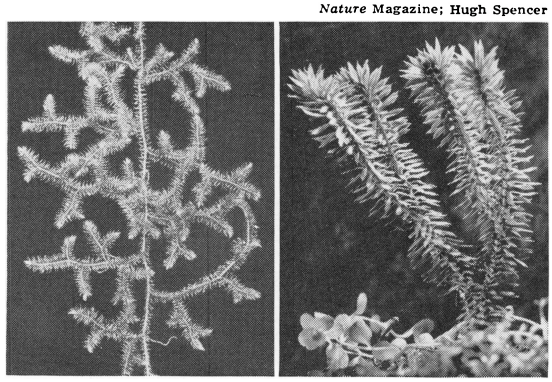
CLUMBER SPANIEL is a short, heavy hunting dog. It has a white coat with orange or lemon colored markings. The dog is heavy for its size. Males stand about 18 inches (46 centimeters) high at the shoulder, and weigh about 60 pounds (27 kilograms). Females weigh less.

The Clumber spaniel was developed in the 1800's in England, and it is still common there. It is named for Clumber Park, the home of a nobleman who developed the breed. The dog is uncommon in the United States. It is too slow to be useful in the larger hunting areas found in the United States. MAXWELL RIDDLE

CLUTCH. See TRANSMISSION; AUTOMOBILE (The Drive Train).

Club Mosses Are Very Attractive Plants. They are popular decorations in the house at Christmastime.

Nature Magazine; Hugh Spencer



CLYDE, *klyd*, RIVER, is the principal commercial waterway in Scotland. The River Clyde rises in the Southern Uplands of Scotland and flows northward for 100 miles (160 kilometers), draining the counties of Lanark, Renfrew, and Dumbarton. The Falls of Clyde near the town of Lanark once furnished the power for many mills in the Lowlands. Shipbuilding yards line the banks of the Clyde in Glasgow, the largest city in Scotland. The *Queen Mary*, *Queen Elizabeth*, and other famous ships were built there. Below Glasgow, the river widens into the Firth of Clyde, an inlet of the sea over 50 miles (80 kilometers) long. See also FIRTH OF CLYDE. JOHN W. WEBB

CLYDESDALE. See HORSE (Draft; color picture).

CLYMER, GEORGE (1739-1813), was one of the Pennsylvania signers of the Declaration of Independence and of the United States Constitution. An early patriot, Clymer headed a committee to persuade Philadelphia merchants not to sell British tea sent over in 1773. He served on the Pennsylvania Committee of Safety, and in the first U.S. House of Representatives from 1789 to 1791. He also was president of the Philadelphia Bank and of the Academy of Fine Arts. Clymer was born in Philadelphia. ROBERT J. TAYLOR

CLYTEMNESTRA, *KLY tuhm NEHS truh*, in Greek legend, was the wife of Agamemnon. While he fought in the Trojan War, she fell in love with his cousin Aegisthus. She and Aegisthus killed Agamemnon when he returned from Troy. Clytemnestra's son, Orestes, later killed her and Aegisthus. JOSEPH FONTENROSE

See also AGAMEMNON.

CNOSSUS. See KNOSSOS.

CNUT. See CANUTE.

COACH is a four-wheeled vehicle drawn by animals. Coaches served as the main means of public travel before the development of railroads. They were usually pulled by horses, and carried passengers, mail, and express freight. The word *coach* comes from *Kocs*, a town in Hungary where an early coachlike vehicle was built in the 1450's. Emperor Frederick III of Germany built one of the first real coaches in 1474.

Coaches developed from the two-wheeled wagons and carts people had used since the time of the ancient Egyptians over 5,000 years ago. Their use spread throughout Europe during the 1500's. But travel by horseback was more comfortable, because of the poor roads and riding qualities of coaches. For years, coaches were used mainly for state occasions. The first public coach line in England began about 1640. JOHN H. WHITE

See also STAGECOACH; WAGON.

COACH is a person who drills athletes in the fine points of sports. The head coach is the team director in most sports. In professional baseball, the director is usually called a *manager*. Coaches teach techniques, conduct practice, determine strategy, and decide who will play. Coaching began in colleges in the mid-1800's. The first coaches were student athletes. Later, professional coaches were hired. Coaches of public school teams are certified teachers. WALTER HAROLD GREGG

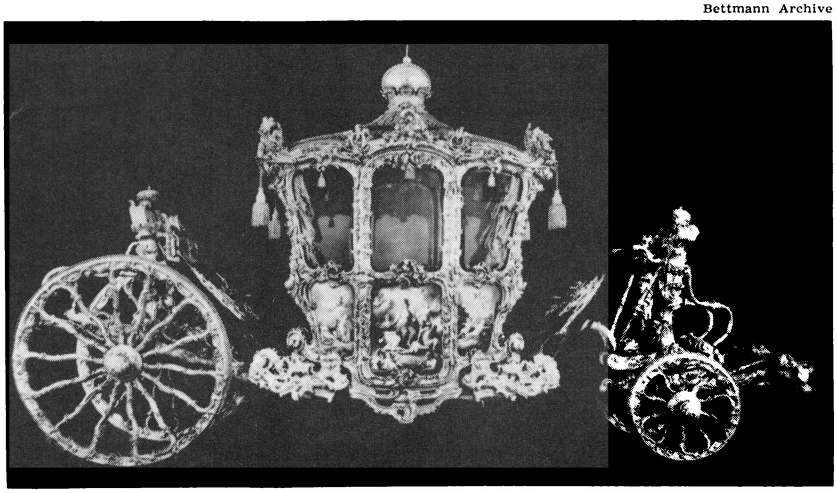
COACH DOG. See DALMATIAN.

COAGULANT, *koh AG yuh luhnt*, is any substance that causes a fluid to clot, or thicken. Milk curdles because *rennin*, an enzyme, causes clots to form. One of the most important coagulant actions is the clotting of blood. Scientists have found many blood-clotting factors. The combined action of all of them produces a blood clot. If any one factor is missing, the tendency for blood to clot is reduced. Doctors then try to supply the missing substance. For example, in the blood disease *hemophilia*, doctors use an antihemophilic globulin to help the blood to clot. In other diseases, they may give the patient vitamin K or fibrinogen to induce the blood to clot and control hemorrhages. WILLIAM DAMESHEK

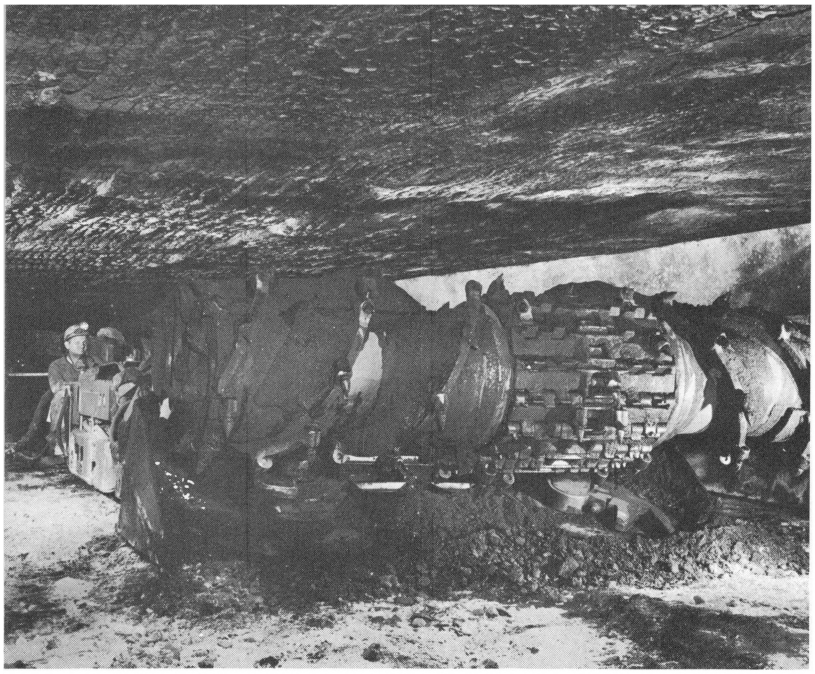
See also BLOOD (Blood Clotting); FIBRIN; VITAMIN (Vitamin K); ANTICOAGULANT; HEMOPHILIA.

COAHUILA, *KOH ah WEE lah* (pop. 1,114,956; area 58,522 sq. mi., or 151,571 km^2), is a state in northern Mexico, across the Rio Grande from Texas. For location, see MEXICO (political map). Saltillo is its capital. Coahuila is a region of desert and mountains. Irrigation projects have made the area around Torreón a rich cotton- and wheat-growing region (see TORREÓN). Coal mines lie near Nueva Rosita. The Mexican and U.S. governments have built the Amistad Dam on the Rio Grande near Acuña for conservation, flood control, hydroelectric power, and recreation. Coahuila was one of the original states of Mexico. It included Texas until Texas won independence in 1836. CHARLES C. CUMBERLAND

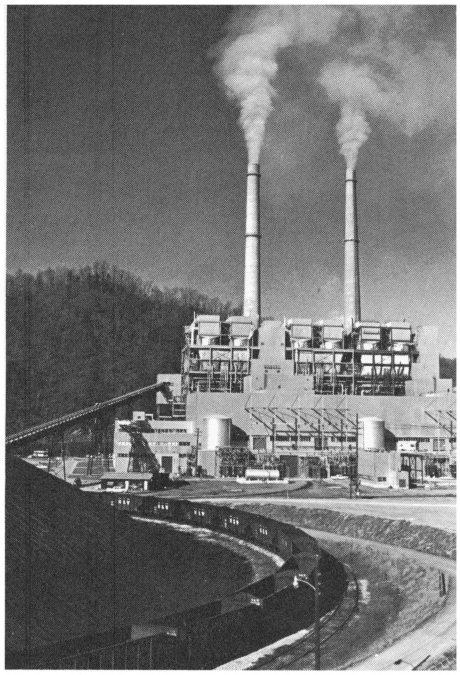
Bettmann Archive



An Imperial Coach, elaborately carved and painted, served the Court of Vienna between 1712 and 1763. Fine carvings decorate the carriage and the rims and spokes of its wheels.



Coal Age Magazine



American Electric Power Service Corporation

The Continuous Miner, *left,* which rips coal from the wall of a mine and scoops it up, is one of many kinds of machines used in modern coal mining. An electric power plant, *right,* burns huge amounts of coal to produce the energy needed to operate its generators.

COAL

COAL is a soft black or brown rock. Its ability to burn makes it one of the most useful rocks dug from the ground. Coal can be burned to heat buildings. But its most important use is to produce steam to make electricity. Coal provides heat and steam for many other industries. Baked coal called *coke* is used in blast furnaces to produce steel. Coal also can be made into other kinds of fuel and hundreds of useful chemical products.

Coal, along with other valuable natural resources such as iron ore and petroleum, has helped make the United States the most important industrial nation in the world. The United States produces more coal than any other country except Russia.

Coal is sometimes called *buried sunshine.* This is because coal captured the sunlight that fell on ancient forests long before there were men on the earth. When we burn coal today, we are using this captured energy from the sun.

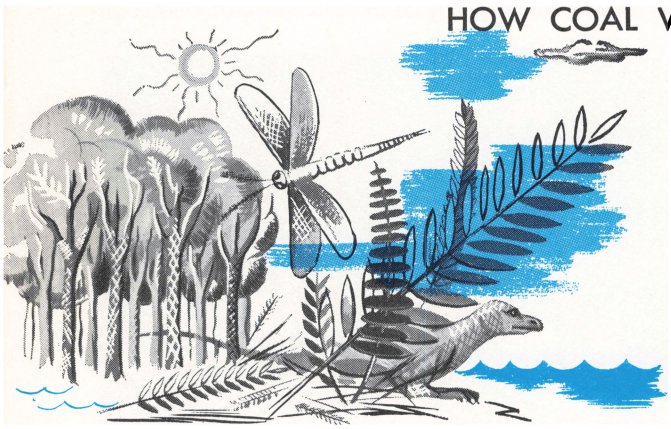
In the United States, coal supplies more than one-fifth of the power and heat the nation uses. Coal furnishes an even larger percentage of energy in other industrial countries.

This article was critically reviewed by the National Coal Association.

How Coal Was Formed

A chunk of coal looks black and smooth. But if you look at a piece of coal under a microscope you will see

HOW COAL WAS FORMED



1. Dense Forests and Swamps covered much of the earth's surface hundreds of millions of years ago. They were filled with strange-looking trees, giant rushes, and wide-spreading ferns. Among the plants lived big lizards and giant insects.

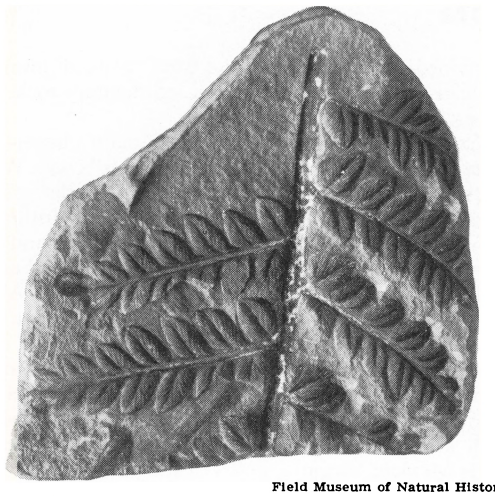
2. As the Giant Plants Died, they fell into the swamps. The dead trees and ferns became tangled in a mass of decayed vegetable matter. This spongy, brown vegetable matter is called *peat,* the first material in the formation of coal.

that it is colored red and gold and arranged in layers. If you look closely at a piece of coal you may be able to see the markings of plants on it. These markings were made by the plants from which coal was formed. See accompanying illustrations, showing a fern fossil and the way coal was formed.

Time of Formation. Some coal was formed 400 million years ago. But most high-rank coal, such as that found in Pennsylvania, was formed more than 250 million years ago, during a time that geologists call the *Carboniferous Period* (see EARTH [table: Outline of Earth History]). Some coal is being formed in small quantities even now.

During the time that most coal was formed, the air was damp and steamy. Most of the plants were huge strange-looking ferns and trees that had no flowers. As these plants died, others grew on top of them. This happened time after time for thousands of years. The plants rotted and turned into a substance called *peat*, which looks like rotted wood. After a while, wide areas of the earth's surface sank. Streams and oceans poured in, carrying mud and sand which covered the peat. The pressure of the water above squeezed down the mass of peat and gradually formed it into coal. Geologists have estimated that a thickness of from 5 to 8 feet (1.5 to 2.4 meters) of rotted plants and ferns was needed to form 1 foot (0.3 meter) of coal. Occasionally, the earth's crust *buckled* (folded). This movement greatly increased both pressure and heat beneath the surface. The increased pressure and heat formed the higher ranks of coal.

Coal Beds. Deposits of coal vary in thickness from less than 1 inch (2.5 centimeters) to more than 100 feet (30 meters). Most coal is mined from beds which are from $2\frac{1}{2}$ to 8 feet (76 to 240 centimeters) thick. These deposits are sometimes called *seams* (veins), but geologists prefer to use the word *bed*, because coal was formed in wide bedding areas. Coal deposits are sandwiched between layers of rock and dirt. The deposits may be level, sloping, or tipped on end, depending on whether they have been affected by the cracking and folding of the earth's crust. Many of the deposits in the mountain



Field Museum of Natural History

A Fern Fossil. The plants that helped to form coal ranged from delicate mosses, ferns, and rushes to the largest trees. On this lump of coal may be seen a fragment of a fern.

sections of the eastern part of Pennsylvania are tilted at various angles.

Coal beds may lie deep in the ground or near the surface. In hilly or mountainous country, the coal often is exposed on the hillside. But it is likely to be covered with dirt or weathered from exposure and hard to recognize. Excavations for buildings or highways frequently uncover coal beds. Sometimes coal is found in drilling for water, oil, or gas. But the principal method of locating coal is to use core drillings. This is done by drilling out a *core* (column) from the earth's crust to indicate, layer by layer, what is under ground.

Chief Kinds of Coal

The plants which became coal took from the air the carbon they needed for their growth. They used a process made possible by sunlight. When the plants were squeezed together by water pressure, large amounts of oxygen and hydrogen were driven out, while the carbon

3. New Plants Grew on Top of the Old. Then they, too, died and became part of the mass of peat. Water sometimes covered the area. Different thicknesses (*1*, *2*, *3*) were caused by dirt and sand (*a*, *b*) being deposited between layers of peat.

4. Heat and Pressure caused different types of coal to be formed. Where the heat and pressure were greatest, usually as the result of folding of the earth's crust, the soft coal (bituminous) was formed into the hardest rank of coal (anthracite).

remained. Because coal has no fixed chemical formula, geologists classify it merely as a sedimentary rock. See Rock (Sedimentary Rock).

Coal usually is divided into two main classes—*anthracite* ("hard" coal) and *bituminous* ("soft" coal). When anthracite was formed, it was squeezed under greater pressure than was bituminous. As a result, anthracite contains the highest percentage of carbon and the lowest percentage of moisture. Anthracite makes up only a small part of the world's supply of coal. About half of the world's coal reserve is bituminous coal. The rest of the reserve is still softer coal.

Anthracite generally lies deeper in the earth than bituminous. Nearly all the anthracite in the United States is found in eastern Pennsylvania. Small beds of this hard coal are also located in Alaska, Arkansas, Colorado, New Mexico, Virginia, and Washington.

About 40 per cent of the anthracite is used for household and commercial heating. When anthracite burns, it produces almost no smoke. It sells for a higher price than bituminous coal, though its heating value is slightly less than that of the better grades of bituminous.

Bituminous Coal is the most important and the most plentiful *rank* (type) of coal. It is the chief fuel in plants that generate electricity with steam. It also has other important industrial uses. It provides coke for the steel industry, and is the raw material for thousands of coke by-products including gas, light oils, and chemicals. Bituminous coal is also used to produce aluminum, cement, food, paper, and textiles. People use bituminous coal to heat homes and buildings.

Large deposits of bituminous coal are found in many states of the Union, both east and west of the Mississippi River. The most important bituminous coal beds in the United States are located in an area west of the Appalachian Mountains. This region extends from Ohio and Pennsylvania southwest to Alabama. Nearly 75 per cent of the bituminous coal mined in the United States each year come from this eastern coal area.

Other Kinds of Coal are softer varieties which contain less carbon and more moisture than the better types of coal. *Subbituminous coal* contains about 25 per cent moisture, and it burns readily. It can be used for heating, generating electricity, and other purposes. Important deposits lie in Alaska, Arizona, Colorado, Montana, New Mexico, and Wyoming.

Brown coal and *lignite* are brownish-black coals that contain about one-half water. Lignite is the harder type of brown coal. There are large deposits of lignite in the northwestern United States and in western Canada. Peat is one of the earliest stages of coal. The remains of plants and ferns which have been preserved may be clearly seen in peat. Peat contains a very high percentage of water. Peat has been used as a fuel for hundreds of years in Ireland, England, and Germany.

How Coal Is Mined

Mining Methods. There are two general methods used to mine coal. These are (1) *strip* (surface) mining, and (2) *underground* (deep) mining. Miners usually use strip mining when the coal beds lie close to the surface of the earth. Otherwise, they use underground mining methods. About half of the coal produced in the United States comes from underground mines.

Strip (Surface) Mining. In this method, giant power shovels or other earth-moving equipment remove the *overburden*, the layer of earth and rock that covers the coal seam. When the coal is exposed, it is broken up, usually by explosives, and loaded by smaller power shovels into huge trucks. The trucks carry the coal to preparation plants. Strip mining is fast and efficient. However, it can ruin the appearance of an area and leave banks of land exposed to erosion. For these reasons, many states have restricted strip mining or required that the land be made productive again after it has been mined. The coal industry has developed many ways of reclaiming strip-mined areas, including planting crops on the land or turning it into a recreation area.

Underground (Deep) Mining includes several types of mines. The most important of these are (1) shaft mines, (2) drift mines, and (3) slope mines. Each type of mine is best suited to removing the coal from a particular type of coal bed.

Shaft Mines reach coal beds that lie far below the earth's surface. A hole is dug straight down to the coal. The miners then dig horizontal entries through the seams of coal. Elevators carry the miners, equipment, and coal between the coal seam and the surface. Separate shafts are dug to provide ventilation for the working rooms far underground. The average depth of shaft mines in the United States is 260 feet (79 meters).

Drift Mines are used to reach coal beds in hillsides. The entrance is located where the coal is exposed on the hillside, and the tunnel is dug through the coal bed.

Slope Mines are also used to reach coal beds in hilly areas. Miners open a sloping tunnel through the ground to the coal bed level. The miners and their machines are moved in and out of the mine on cars that are pulled by electric locomotives along steel tracks. Coal is taken out in similar cars, or by conveyor belts.

Underground Mining Systems. Coal is mined according to a definite plan. The plan must allow as much coal to be removed as possible, in the safest and most efficient way possible.

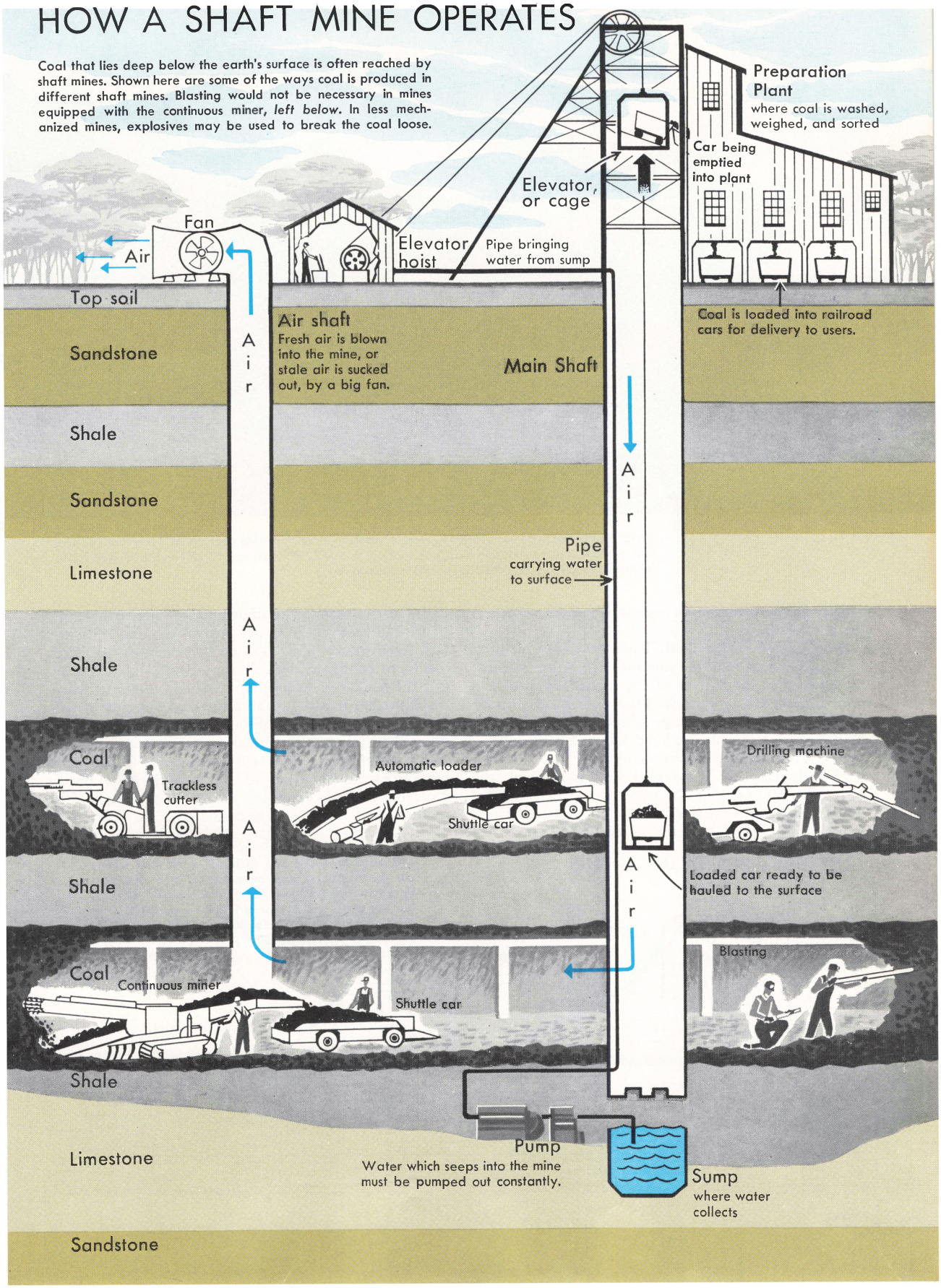
The wall of the bed from which the coal is taken is called the *mine face*. In cutting into this mine face, there are two general mining systems: (1) the room-and-pillar system, and (2) the longwall system.

Room-and-Pillar Mines are composed of a series of rooms cut into the coal bed from numerous entries. The miners leave *pillars* (columns) of coal standing to help support the roof until they mine out a particular area. Then, as the miners move back to the main entry, they systematically remove the pillars and permit the roof to fall. This system is used in most of the underground coal mines of the United States.

Longwall Mines are common in Europe and are now found in the United States. In this system, coal is mined by a machine which is pulled back and forth across a face 240 feet (73 meters) or more in length. The loosened coal falls onto a conveyor belt which carries it away. Movable steel props support the roof over the immediate work area, and as the miner works the machine deeper into the seam, the roof supports are advanced. The roof behind is allowed to fall. Miners, equipment, and coal move to and from the face through *haulageways* (tunnels) that open along each side of the face. One advantage of the longwall system is that

HOW A SHAFT MINE OPERATES

Coal that lies deep below the earth's surface is often reached by shaft mines. Shown here are some of the ways coal is produced in different shaft mines. Blasting would not be necessary in mines equipped with the continuous miner, *left below*. In less mechanized mines, explosives may be used to break the coal loose.



National Coal Association

Strip Mines use huge excavators to remove earth and rock covering coal seams. The giant machine shown above has a powerful wheel, *left*, that cuts away 3,500 short tons (3,180 metric tons) of waste an hour and piles it over 420 feet (128 meters) away.

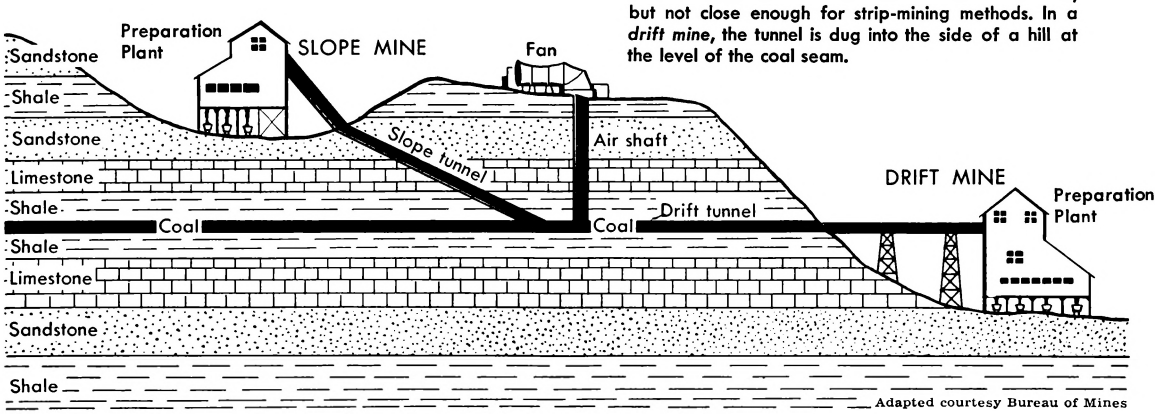
almost all the coal can be removed because no pillars are left standing.

Breaking Down the Coal. There are many methods of breaking coal from the mine face in lumps suitable for hauling to the surface of the mine. The coal was once broken off by men working with picks. But 95 per cent of all the coal is now mined in modern, mechanized mines. The slower hand labor of early mining methods has disappeared in such mines.

Undercutting. Before the coal wall is cracked, the miners usually cut out the mine face at the bottom of the coal bed so the coal can be shattered more easily by explosives. This undercutting may be done by hand, but more than 95 per cent of the undercutting in United States mines is done by machines. Cutting machines equipped with sharp, powerful blades, tear out the coal in a wide groove, or *kerf*. Some cutting machines are built to cut into the coal not only at the bottom, but also at the top and sides of the face. Another simple method of breaking down coal is called *shooting-off-the-solid*. The coal is blasted off the bed without any undercutting to help break it down. But a dangerously large explosive charge is needed in this method, and much dust and fine coal are produced.

SLOPE AND DRIFT MINES

This diagram shows two different ways that miners can reach coal. A *slope mine* uses a tunnel dug at a slant to reach coal that lies near the earth's surface, but not close enough for strip-mining methods. In a *drift mine*, the tunnel is dug into the side of a hill at the level of the coal seam.



Adapted courtesy Bureau of Mines

Cracking the Coal Wall. If explosives are to be used in breaking down the coal, shot holes are drilled at intervals along the face of the coal bed. The explosives are inserted in these holes. When the explosion occurs, the coal wall cracks into pieces. Black powder and dynamite were once used as the chief explosives in coal mines. But they had a tendency to set fire to the gases and dust that accumulate in mines, and they have been discarded as too dangerous. Today, coal-mining companies in the United States widely use *permissible explosives* approved by the United States Bureau of Mines. The Bureau tests these explosives to make sure that they are safe for use in mines. Cylinders of compressed air or liquid carbon dioxide are also widely used in American mines. The cylinders are placed in the shot holes. When the compressed air or gas is released, it expands with such force that the coal wall is shattered as thoroughly as if dynamite had been set off. Compressed-air cartridges are widely used in Britain.

Continuous Coal-Mining Machines. Since World War II, many machines have been developed to mine coal mechanically. Use of these machines reduces accidents and reduces mining costs. A *continuous mining machine* can cut the coal loose and load it in one operation. Two men running a continuous mining machine can mine coal at the rate of about 12 short tons (11 metric tons) a minute.

At surface mines where a rising hillside makes overburden too thick to remove, miners may use a *coal auger.* A coal auger is a giant bit which can drill horizontally into a coal deposit and remove the coal from the holes it makes. The auger may bore holes 84 inches (213 centimeters) across and 200 feet (61 meters) deep. See the picture of a coal auger later in this article.

Hauling Coal Out of a Mine. As the coal is mined, tracks are laid in the main haulageway. Cars loaded with coal are pulled over these tracks by small but very powerful electric locomotives. An increasing number of mines use conveyor belts to carry the coal to the surface. In most underground mines, low, flat loading machines gather the loose coal onto shuttle cars. The shuttle cars carry the coal to mine cars or to a conveyor belt. In surface mining, the loose coal is gathered up by large power shovels, and is loaded on trucks.

Sizing. Coal as it is taken from the mine is called *run-of-mine* coal. Pieces range in size from large chunks to a fine powder. Not much coal is sold in this *run-of-mine* form. Most coal is hoisted into a preparation plant where it is separated from impurities and sorted into sizes by being passed through large screens. Each screen has openings of a certain size. Bituminous coal is classified by size. See the color illustration, *From Mine to Bin.*

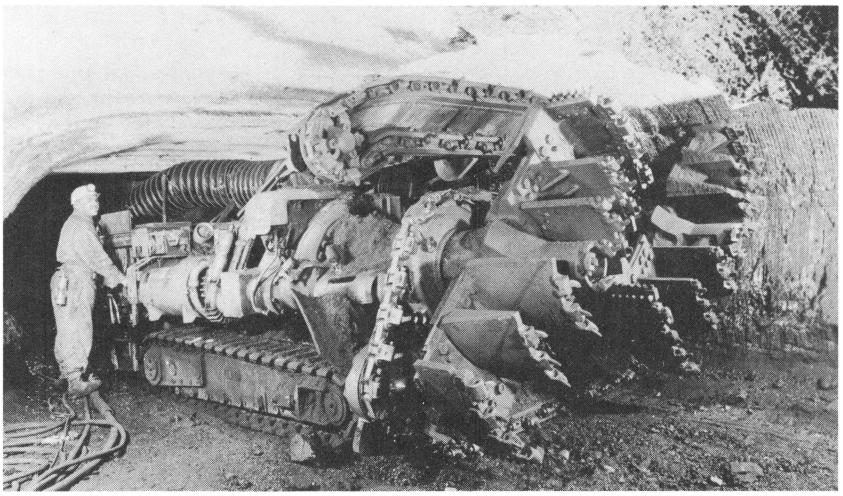
Anthracite must be broken up to remove slate and other impurities embedded in it before it can be divided into sizes. Smaller sizes of anthracite account for a major share of production. But larger sizes bring in more income, because they sell at higher prices.

Powdered coal is used for many industrial purposes, but the most important use of it is in electric power plants. In some plants, coal is crushed into a fine powder and blown into 14-story tall furnaces where the powder flashes into flame. The flame's heat produces steam to make electricity. Powdered coal is also pressed into blocks called *briquettes* for use in home fireplaces. A binding material, such as tar or pitch, is mixed with the powdered coal to hold the briquettes together.

National Coal Association

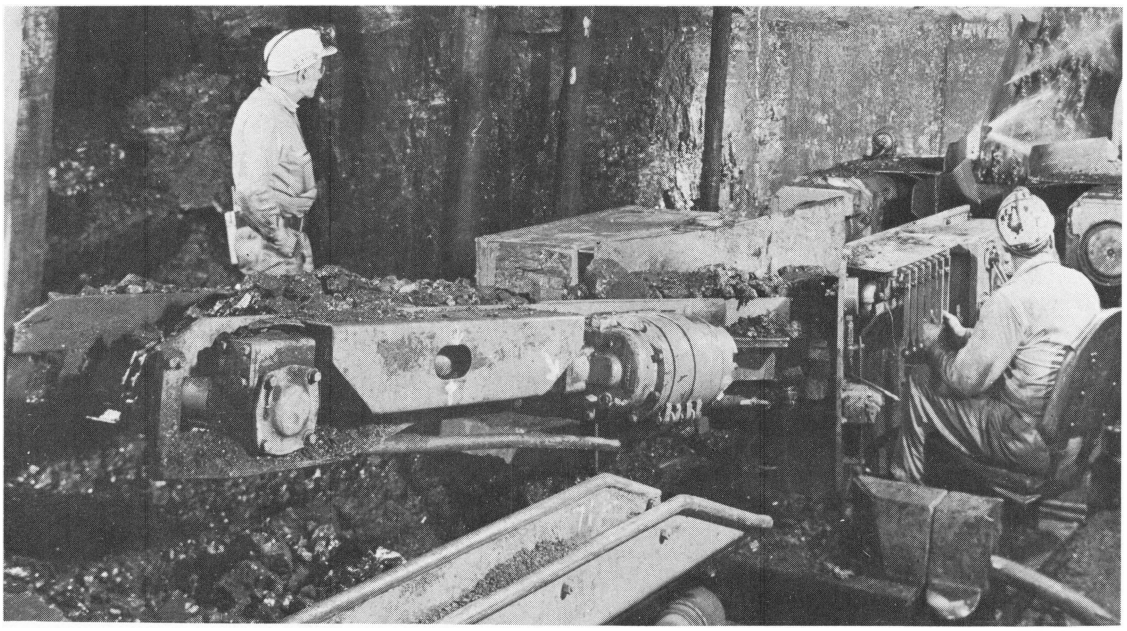
In Underground Coal Mines, miners ride to and from their work in rapidly moving "man-trip cars." Many mines also use electrically powered shuttle cars to carry coal to mine cars or a conveyor belt. The coal is then transported to the surface.

MINING COAL



National Coal Association

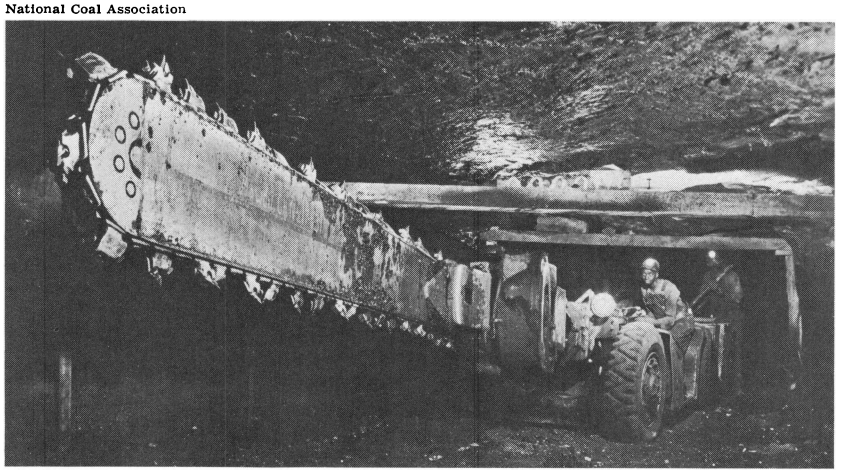
A Continuous Miner, *right,* bites into the face of a coal seam and chews out as much as 12 short tons (11 metric tons) of coal a minute. The coal passes from the front of the machine to the rear end, *below,* where it flows into shuttle cars or onto a conveyor belt. This machine eliminates separate cutting, drilling, blasting, and loading operations.

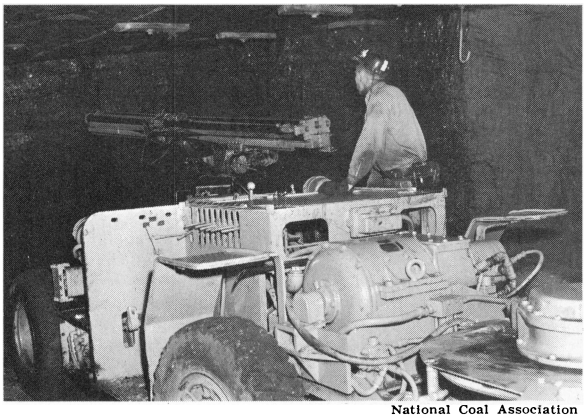


Weirton Steel Company

National Coal Association

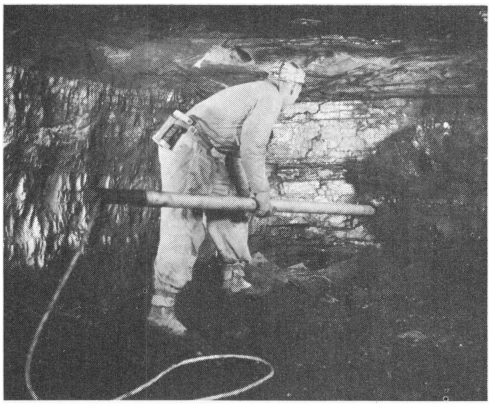
A Cutting Knife on wheels, *right,* looks like a giant sawfish. The operator can make the sharp, powerful blades cut either a vertical or horizontal slot in a coal seam.





National Coal Association

A Portable Coal Drill bores holes for compressed air cartridges or other kinds of explosive charges. Mines that do not have continuous miners use explosive devices to break down coal seams.



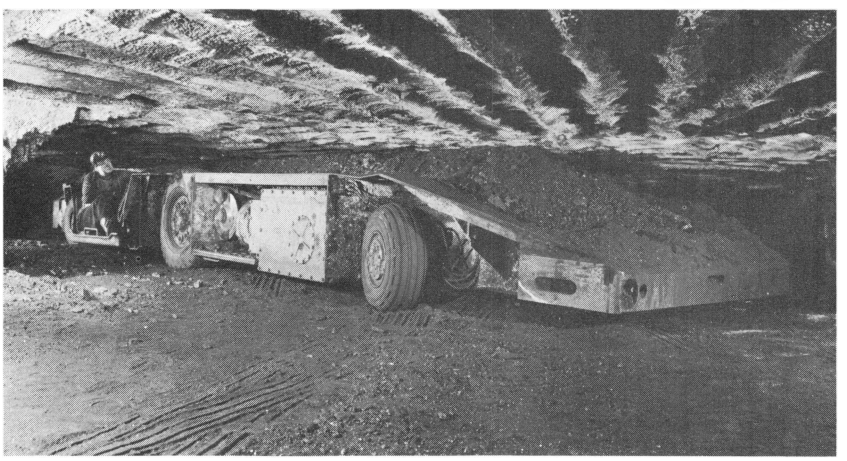
National Coal Association

Preparing to Blast, a miner inserts an air cartridge into a hole in the coal seam. Compressed air is forced into the cartridge and bursts out with explosive force.

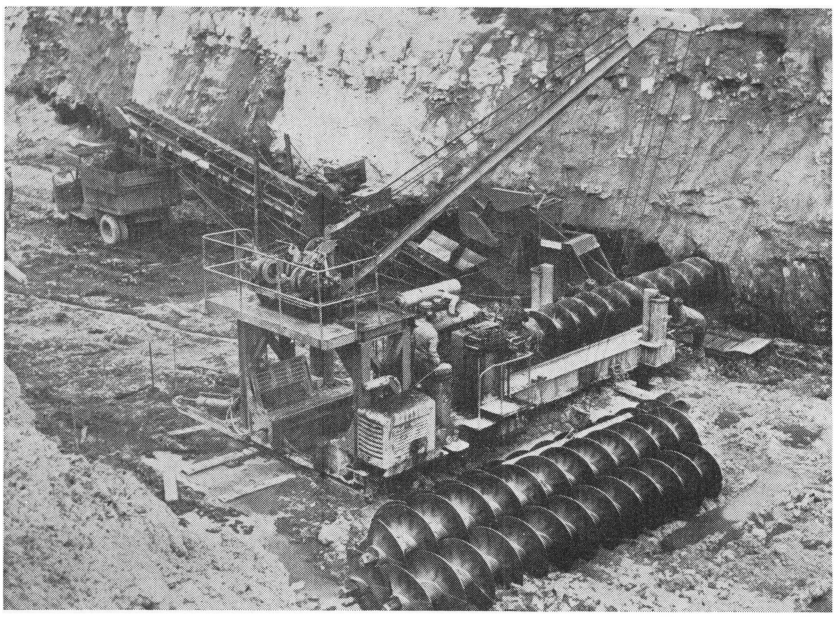
National Coal Association

A Crawler-Type Loader, *right,* picks up coal that was blasted from the face of a seam and loads it in shuttle cars.

National Coal Association



A Shuttle Car, such as this, *right,* hauls the coal from the face of the seam to a mine car or a conveyor belt that carries it to the surface.



National Coal Association

A Giant Coal Auger may be used to reach coal that cannot be strip mined because too much earth and rock cover it. These machines can bore holes 42 inches (107 centimeters) wide and 200 feet (61 meters) deep into coal seams.

Cleaning. Anthracite may have a quantity of slate mixed with the coal as it leaves the mine. After being broken into smaller sizes, the anthracite is sent through mechanical cleaners. These mechanical cleaners automatically remove the slate from the coal. In many bituminous coal mines, little or no slate is found with the coal.

However, bituminous coal may contain clay and other impurities. About half of such coal is also cleaned mechanically. Such mechanical cleaning is done chiefly by machines called *jigs* and *dense-medium* washers. These machines separate the bituminous coal from the heavier impurities that are mixed with it. Sometimes coal is treated with chemicals or sprayed with oil to settle the dust.

Grading. In its natural state, coal is classified by *rank*, which depends on its carbon and ash content, the amount of volatile, or gassy, matter and moisture it contains, and its heat value. As sold in the market, coal is classified by *grade*, which depends on its rank and such other characteristics as the size of the lumps and on special treatment which the coal has received. The grade of coal is important to customers, for it means that the coal will meet certain standards.

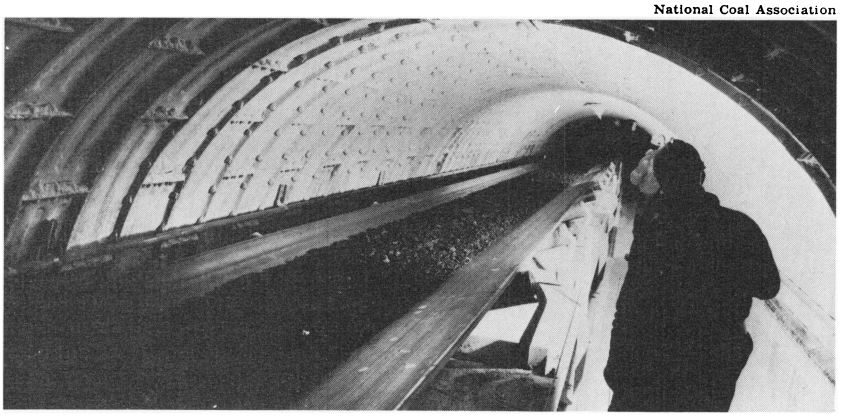
How Coal Is Transported

Shipping. After the coal has been processed at the preparation plant, it is usually loaded into railroad cars or coal barges. Sometimes coal is loaded for shipping directly from the car that brought it to the surface.

Coal needs heavy transportation equipment because the fuel is so heavy and bulky. In the present day, railroad cars transport about two-thirds of the coal produced in the United States. The fuel is carried in open-topped *gondola* or *hopper* coal cars. These cars carry up to 100 short tons (91 metric tons) of coal, but some have been made which can carry as much as 145 short tons (132 metric tons) of coal. Trucking of coal directly from the mines has been gaining importance. But railroads still carry more than six times as much coal from the mines as do trucks.

Several major railroads operate *unit* trains, made up entirely of coal cars that operate directly between mines and major consumers, such as electric power plants.

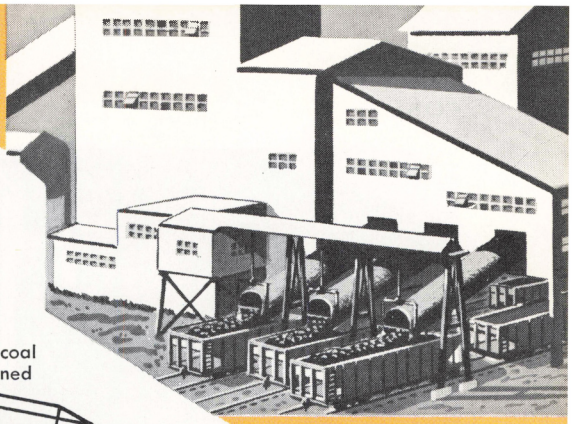
National Coal Association

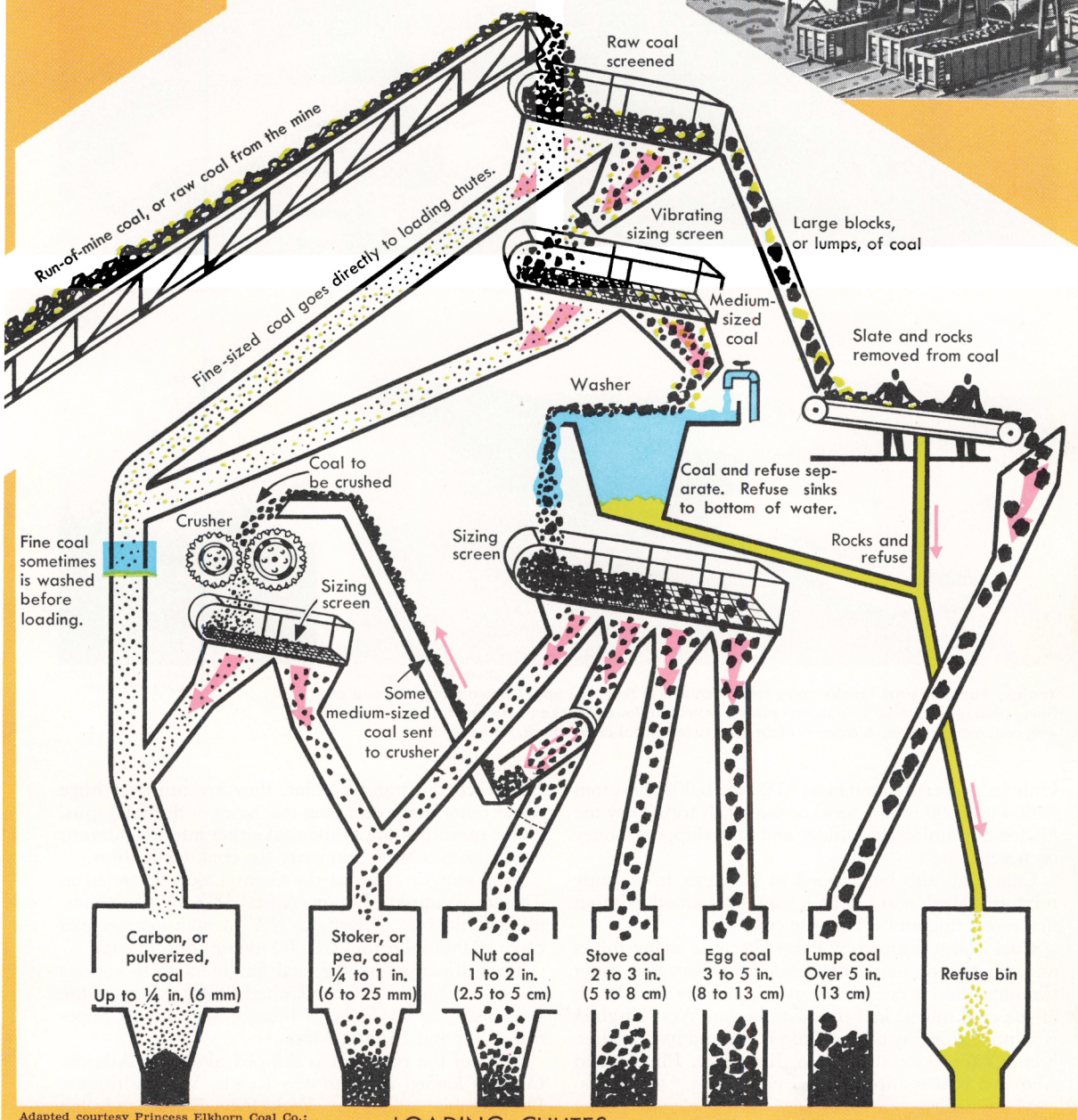


A Conveyor Belt is used in many mines to haul coal to the surface. The belt shown at the left can carry 1,800 short tons (1,630 metric tons) of coal per hour.

FROM MINE TO BIN

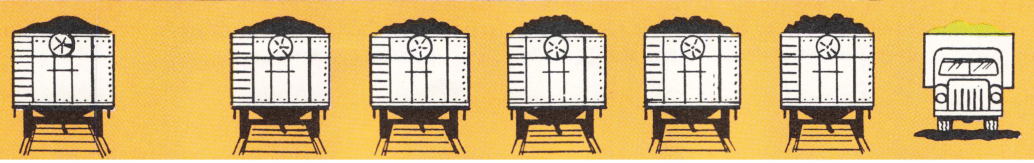
Run-of-mine coal, or coal as it comes up out of the mine, is not ready for use. It must be cleaned, screened, sorted into various sizes, and often crushed.

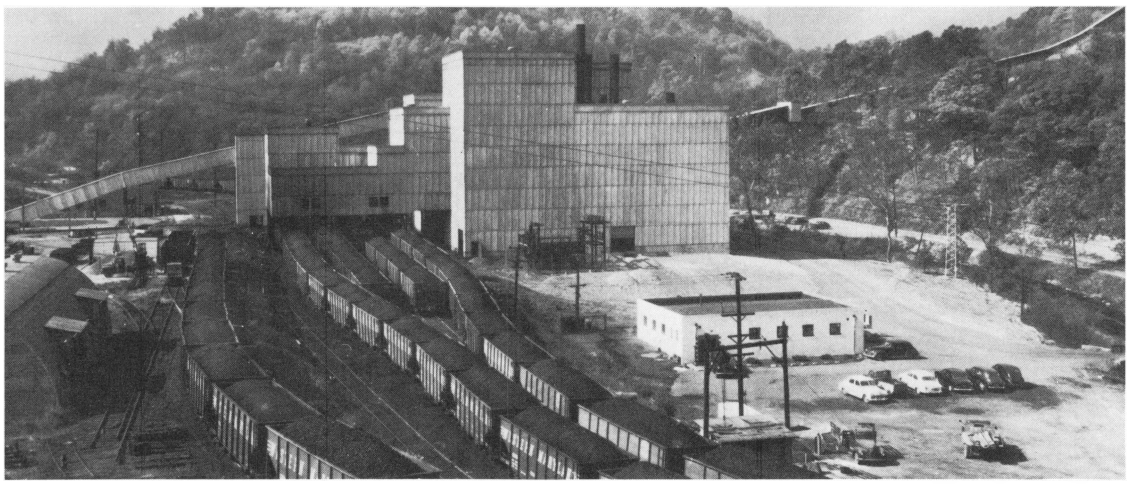




Adapted courtesy Princess Elkhorn Coal Co.; *Steelways;* National Coal Association

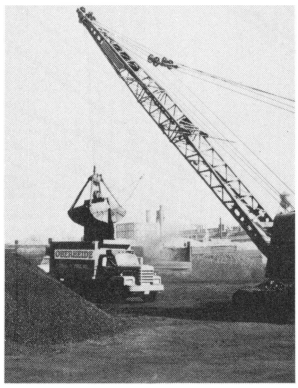
Mixing conveyor makes possible the loading of mixed sizes.





Western Maryland Railway

Peabody Coal Company



Oberheide Coal & Oil Co.
(WORLD BOOK photo)

Trains, Barges, and Trucks carry tons of coal at a time. The upper photo shows railroad cars being loaded at a mine preparation plant. A towboat, *lower left*, can push several barges loaded with coal along a river. A crane is often used to load coal onto a truck, *lower right*.

Unit trains usually haul from 4,000 to 10,000 short tons (3,600 to 9,100 metric tons) of coal each trip. They are loaded and unloaded rapidly and save shippers money on freight rates.

Coal may also be shipped in pipelines in a soupy mixture called *slurry*, which can be burned without first separating and drying the coal.

Coal is also shipped by barge, because many mines and preparation plants are located on rivers and water transportation is cheaper than shipping by rail. Much of the coal mined in Pennsylvania and West Virginia is shipped this way on the Ohio River and its branches. Some coal produced in Ohio, Kentucky, Illinois, and Alabama is also shipped by river.

Many utility companies are building electric power plants near mines and sending electricity over long-distance high-voltage lines to consuming areas. This eliminates the need to transport coal by railroad, barge, or truck, and reduces the cost of electric power.

Much of the coal mined in the Appalachian area is taken by rail to Lake Erie or to the Atlantic Coast, and from there it is shipped by boat. When the railroad cars reach the transfer point, they are run over huge docks onto rotary dumping machines or dumping pits. These machines empty the coal either into freighters or onto conveyor belts that carry the coal to the ships.

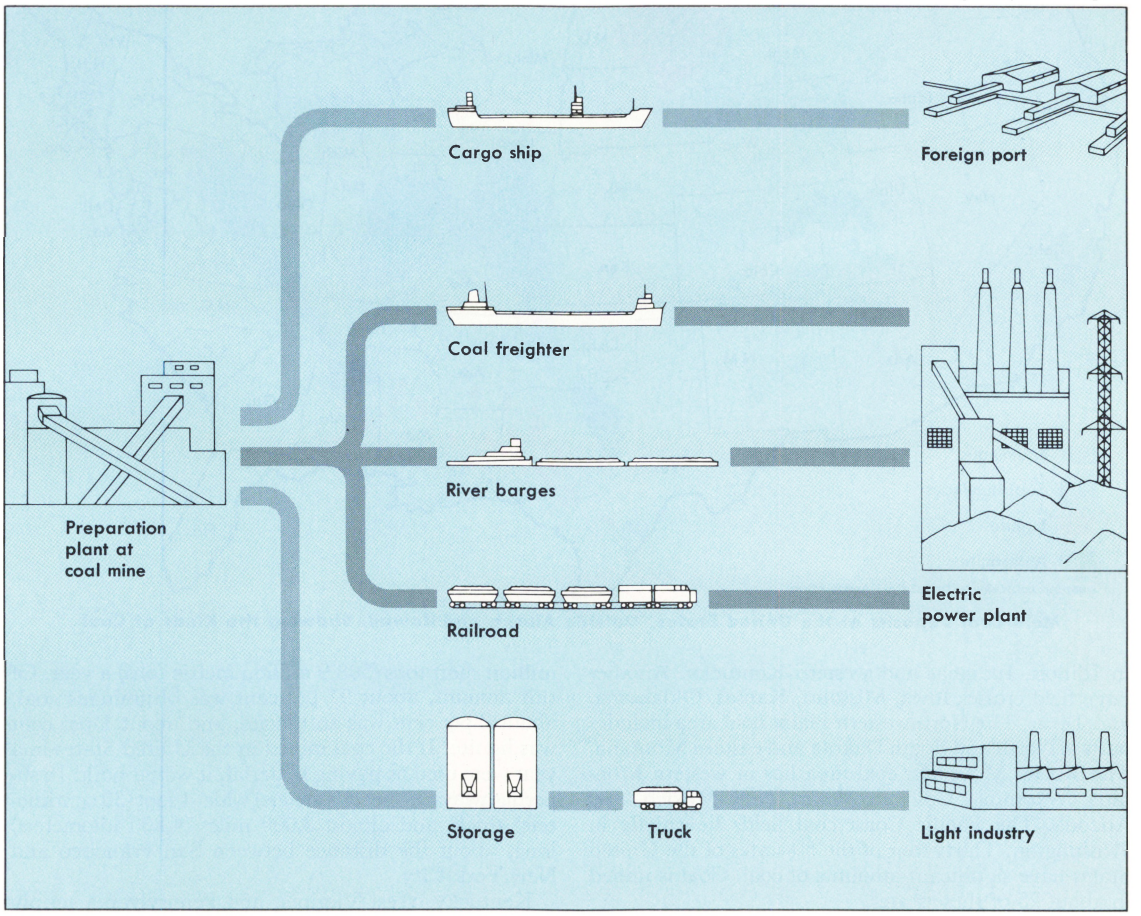
Coal sent by boat on the Great Lakes is loaded in Toledo, Sandusky, Lorain, Ashtabula, and Conneaut, all in Ohio; and in Buffalo, N.Y. A lake steamer can carry 20,000 short tons (18,000 metric tons) of coal.

From these points, the coal freighters go to various places in Canada and the United States. Many of the shipments are to Detroit; Chicago; Milwaukee; Superior, Wis.; and Duluth, Minn.

Most of the coal that is shipped along the Atlantic Coast is loaded in Hampton Roads, Va.; Baltimore; Philadelphia; and New York City. These so-called *tidewater* coal shipments go to ports in other countries. They also go to other ports in the Gulf of Mexico and the Middle Atlantic States, and on the West Coast. Japan is the chief importer of U.S. coal. France and Germany also import large amounts. High-grade coking coals from the United States are in demand in European steel-producing centers.

How Coal Is Distributed Coal is distributed from preparation plants to consumers throughout the world. Cargo ships serve foreign ports. Electric power plants and other large users in the United States receive coal by rail or inland waterways. Trucks deliver coal from storage facilities to smaller users.

WORLD BOOK diagram by Mas Nakagawa



Coal that arrives by ship is unloaded by huge cranes that scoop it out of the holds, and pile it for storage at the pier or load it on railroad cars for shipment.

Storing. Most large consumers of coal try to keep a supply on hand which will last several months beyond their immediate requirements. Sometimes coal is stored in the open, and sometimes in bins. Anthracite and bituminous coal may be kept for long periods of time without losing their heating or power values. But subbituminous coal must be stored or piled carefully to protect it from the weather, and lignite cannot be stored long because it dries out.

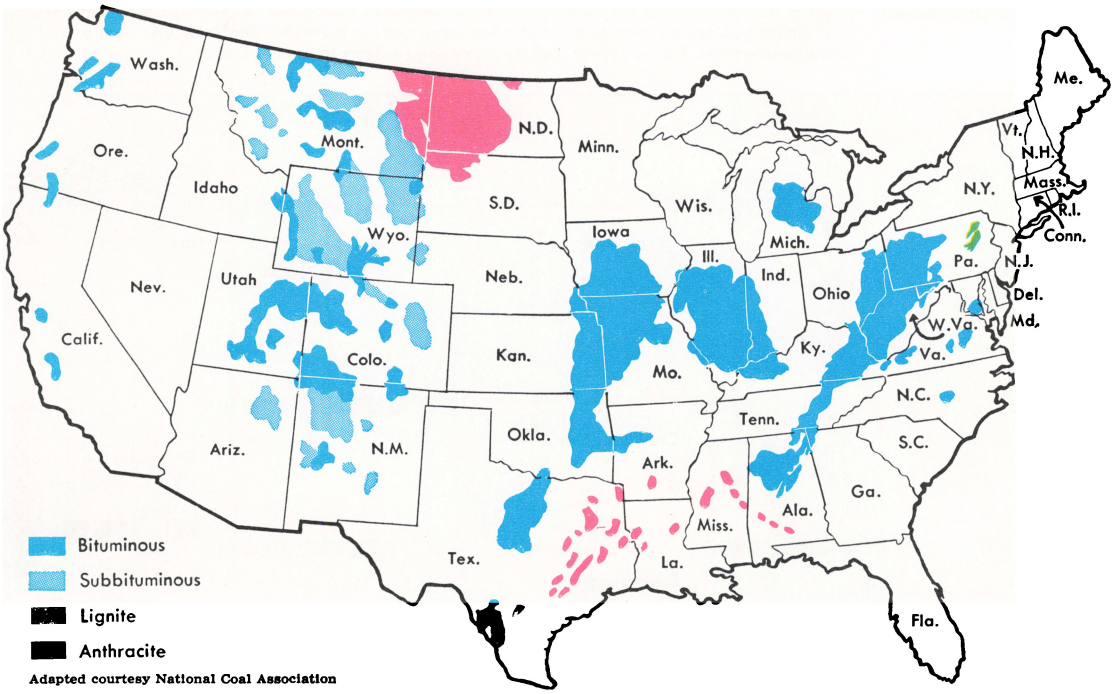
A major problem of coal distributors is having on hand the right grades and sizes of coal to meet the demands of the market. In coalyards, there are usually a large number of bins, each containing a reserve supply of coal of a certain grade. Yet many retail deliveries are made directly from railroad cars.

Where Coal Is Found

World Coal Fields. Most of the world's coal fields have been located. About half of the world's coal supply lies in North America. Russia and China also have large coal deposits. Russia has deposits in both Europe and Asia. Its largest coal fields lie in the Donets Basin and in the Karaganda and Kuznetsk regions. China has especially large coal beds under the North China Plain and in central Manchuria. The largest West German coal fields lie in the Ruhr region. Great Britain also has large coal deposits, especially in the region of the Pennine Chain and in Wales. Poland has large coal fields near its southern border.

Coal deposits are also found under ocean water. In most cases, underwater deposits are mined from shafts or slope openings on the shore. Off-shore mining is more expensive and more difficult than underground or surface mining. For these reasons, the output from underwater mining is small. Japan is the largest producer of underwater coal. Canada, Chile, Great Britain, and Taiwan also have small underwater operations.

United States Coal Fields. The chief coal fields of the United States are spread over several wide areas. The great Appalachian coal area extends from Alabama to Pennsylvania and Ohio. A second huge coal area lies



Adapted courtesy National Coal Association

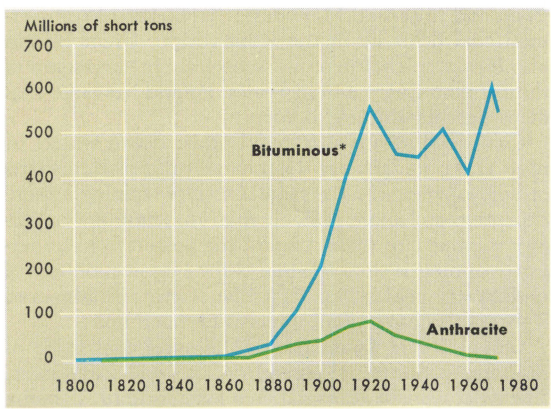
Main Coal Deposits of the United States, Outside Alaska and Hawaii, Showing the Kinds of Coal

in Illinois, Indiana, and western Kentucky. Another large field crosses Iowa, Missouri, Kansas, Oklahoma, and Texas. The Northwestern Plains coal area includes parts of North and South Dakota and eastern Montana. The Rocky Mountain coal area lies in western Montana, Wyoming, Colorado, Utah, New Mexico, and Arizona. The Pacific Coast coal fields lie chiefly in Washington. Thirty-four of the 50 states of the United States have significant amounts of coal. Coal is mined in about 25 of these states.

Amount of Coal Mined. The United States is the world's second largest coal producer. It mined about 18 per cent of the world output in the early 1970's. In the early 1970's, the United States produced about 561 million short tons (508.9 million metric tons) a year. Of this amount, about 97 per cent was bituminous coal, about 2 per cent was anthracite, and about 1 per cent was lignite. If the coal mined in the United States in a year were used as paving material, it would build 16 superhighways 50 feet (15 meters) wide, 1 foot (30 centimeters) thick, and almost 3,000 miles (4,800 kilometers) long, about the distance between San Francisco and New York City.

Kentucky, West Virginia, and Pennsylvania supply about 60 per cent of the bituminous coal, and Pennsylvania supplies all the anthracite in the country. The other chief coal-producing states are Illinois, Ohio, Virginia, Indiana, and Alabama. Although more than

COAL MINING IN THE UNITED STATES SINCE 1800



*Including a small amount of lignite
Source: U.S. Bureau of Mines

Year	Anthracite In short tons	Anthracite In metric tons	Bituminous* In short tons	Bituminous* In metric tons
1800	—	—	108,000	98,000
1810	2,000	2,000	176,000	160,000
1820	4,000	4,000	330,000	299,000
1830	235,000	213,000	646,000	586,000
1840	1,129,000	1,024,000	1,345,000	1,220,000
1850	4,327,000	3,925,000	4,029,000	3,655,000
1860	10,984,000	9,965,000	9,057,000	8,216,000
1870	19,958,000	18,106,000	20,471,000	18,571,000
1880	28,650,000	25,991,000	50,757,000	46,046,000
1890	46,469,000	42,156,000	111,302,000	100,971,000
1900	57,368,000	52,043,000	212,316,000	192,610,000
1910	84,485,000	76,644,000	417,111,000	378,397,000
1920	89,598,000	81,282,000	568,667,000	515,886,000
1930	69,385,000	62,945,000	467,526,000	424,132,000
1940	51,485,000	46,706,000	460,772,000	418,005,000
1950	44,077,000	39,986,000	516,311,000	468,389,000
1960	18,817,000	17,070,000	415,512,000	376,946,000
1970	9,729,000	8,826,000	602,932,000	546,971,000
1971	8,727,000	7,917,000	552,192,000	500,940,000

*Including a small amount of lignite.

90 per cent of the coal mined in the United States came from coal fields east of the Mississippi River, eastern reserves make up only about 30 per cent of the nation's total. The 14 Northeastern states use 60 per cent of the coal produced in the United States.

Other leading coal-mining countries are Russia, China, Germany (East and West), and Poland. These countries and the United States mine about three-fourths of the world's output of coal.

For more detailed information on the coal deposits in various states and countries, see the Natural Resources sections of the articles on the states and countries.

World Coal Reserves are estimated to be about $6\frac{1}{2}$ thousand billion short tons (5.9 thousand billion metric tons). About half of this reserve is in North America. Asia has about two-fifths and Europe has about a tenth. U.S. coal reserves are estimated at about 15 hundred billion short tons (13.6 hundred billion metric tons). This includes beds down to 3,000 feet (910 meters) below the surface. Some good-quality coal deposits lie even below that depth, but these are not likely to be mined for many years. Today, beds are seldom mined that are more than 600 feet (180 meters) below the surface. It is estimated that there are 13 hundred billion short tons (11.8 hundred billion metric tons) of additional coal in unmapped and unexplored areas throughout the United States.

No one can tell exactly how long the coal resources of the United States will last. This will depend on a number of factors. These include the rate of consumption of American coal, the life expectancy of American reserves of oil and natural gas, the level of imports of these competitive fuels, and the future price of coal compared to other sources of energy. However, experts expect that the United States has enough coal to last, at present production rates, for about 1,500 years. This estimate includes about 875 billion short tons (793.8 billion metric tons) of subbituminous coal and lignite in the western United States. Even at increased rates, coal will last many years after such energy sources as oil and natural gas are gone.

Conservation of Coal

Coal that is consumed can never be replaced. Even the abundant coal resources of the U.S. must be used wisely. Little coal is used to heat homes. But industry needs more coal than ever before for power and heat. Producers and users must meet increasing demands for coal while guarding against waste.

The United States Geological Survey provides much needed information by mapping coal fields and estimating the coal resources of states. Newly discovered coal beds are analyzed to ensure that the coal will be used for the purpose for which it is best suited. Individual companies also conduct their own exploration and research to increase their own known reserves.

The United States Bureau of Mines estimates that a third of the coal in the ground in the United States will not be used because it cannot be mined. Coal pillars must be left in the mine to support roofs. Some coal cannot be mined because it lies under such restricted areas as towns, roads, and streams. However, United States mines have a higher percentage of recovery than do mines in other countries. United States mines average less than 300 feet (91 meters) in depth, and they have relatively level and thick seams. Many mines in other countries go down 3,000 to 4,000 feet (910 to 1,200 meters) and often have very thin seams and so increase mining costs.

Slightly more than half of the coal in an underground mine can be recovered with the aid of modern equipment and methods. Huge surface mining shovels can uncover most of the coal in a deposit that cannot be mined by underground methods. Augers bore into mountainsides to bring out coal that cannot be mined by usual underground or surface methods.

LEADING COAL-MINING STATES

Tons of coal mined in 1971

Kentucky	119,389,000 short tons (108,308,000 metric tons)
West Virginia	118,258,000 short tons (107,282,000 metric tons)
Pennsylvania	81,562,000 short tons (73,992,000 metric tons)
Illinois	58,402,000 short tons (52,981,000 metric tons)
Ohio	51,431,000 short tons (46,657,000 metric tons)
Virginia	30,628,000 short tons (27,785,000 metric tons)
Indiana	21,396,000 short tons (19,410,000 metric tons)
Alabama	17,945,000 short tons (16,279,000 metric tons)
Tennessee	9,271,000 short tons (8,411,000 metric tons)
New Mexico	8,175,000 short tons (7,416,000 metric tons)

Source: *Minerals Yearbook, 1971*, U.S. Bureau of Mines

LEADING COAL-MINING COUNTRIES

Tons of coal mined in 1971

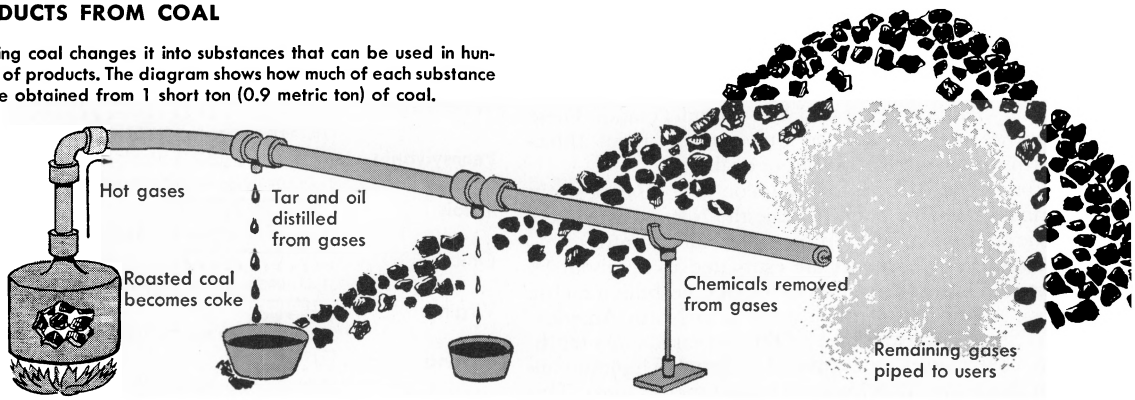
Russia	*698,800,000 short tons (633,941,000 metric tons)
United States	560,919,000 short tons (508,857,000 metric tons)
China	452,000,000 short tons (410,048,000 metric tons)
Germany (East)	293,320,000 short tons (266,095,000 metric tons)
Germany (West)	237,373,000 short tons (215,341,000 metric tons)
Poland	198,424,000 short tons (180,007,000 metric tons)
Great Britain	161,625,000 short tons (146,624,000 metric tons)
Czechoslovakia	124,561,000 short tons (113,000,000 metric tons)
India	80,246,000 short tons (72,798,000 metric tons)
Australia	79,691,000 short tons (72,294,000 metric tons)

*Estimate

Source: U.S. Bureau of Mines

PRODUCTS FROM COAL

Roasting coal changes it into substances that can be used in hundreds of products. The diagram shows how much of each substance can be obtained from 1 short ton (0.9 metric ton) of coal.



1,300 to 1,500 pounds (590 to 680 kilograms) of

COKE

LUMP COKE

Metallurgical coke
- Copper smelting
- Iron smelting
- Lead smelting
- Iron and Steel Casting

Heating purposes
- Homes
- Industry

Calcium carbide
- Acetylene
  - Chemicals
  - Welding

Water gas
- Heating purposes
  - Homes
  - Industry
- Chemicals

Other industrial purposes
- Chemical processing
- Lime burning
- Beet sugar refining
- Manufacture of mineral wool

SCREENINGS OR BREEZE
- Iron ore agglomeration
- Chemical processing
- Steam generation

8 to 10 gallons (30 to 38 liters) of

COAL TAR

Tar acids
- Carbolic acid
  - Pharmaceuticals
- Cresols
  - Lysol
  - Photo developer
  - Plastics
- Phenols
  - Detergents
  - Drugs
  - Dyes
  - Food preservatives
  - Perfumes
  - Rubber chemicals
  - Weedkiller

Tar bases
- Pyridine bases
  - Antiseptics
  - Disinfectants
  - Paint thinner
- Pyridine
  - Clothes waterproofing
  - Sulfa drugs
  - Synthetic vitamins

Naphthalene
- Insecticides
- Fungicides
- Plastic dolls
- Explosives
- Moth balls
- Synthetic fibers

Heavy Oil
- Dyes
- Embalming fluid
- Laxatives
- Wood preservatives

Pitch
- Electrodes
- Insulation
- Paving
- Roofing
- Storage batteries
- Waterproofing

3 gallons (11 liters) of

LIGHT OIL

Benzene
- Synthetic fibers
  - Nylon
- Aniline dyes
- Food preservatives
- Motor fuel
- Plastics
- Synthetic rubber
- Tanning fluids

Toluene
- Antiseptics
- Fingernail polish
- Printing ink
- Saccharin
- TNT explosive
- Aviation gasoline
- Detergents

Xylene
- Motor fuel
- Gasoline solvents
- Herbicides

Solvent Naphtha
- Rubber solvent
- Electrical insulation
- Linoleum
- Varnish

5 to 6 pounds (2.3 to 2.7 kilograms) of

AMMONIA

Ammonium sulfate
- Fertilizers
- Chemicals

Ammonia liquor
- Fertilizers
- Explosives
- Household ammonia
- Refrigerant
- Nitric acid

Diammonium phosphate
- Fertilizer
- Fire retardant

9,500 to 11,500 cubic feet (269 to 326 cubic meters) of

COAL GAS

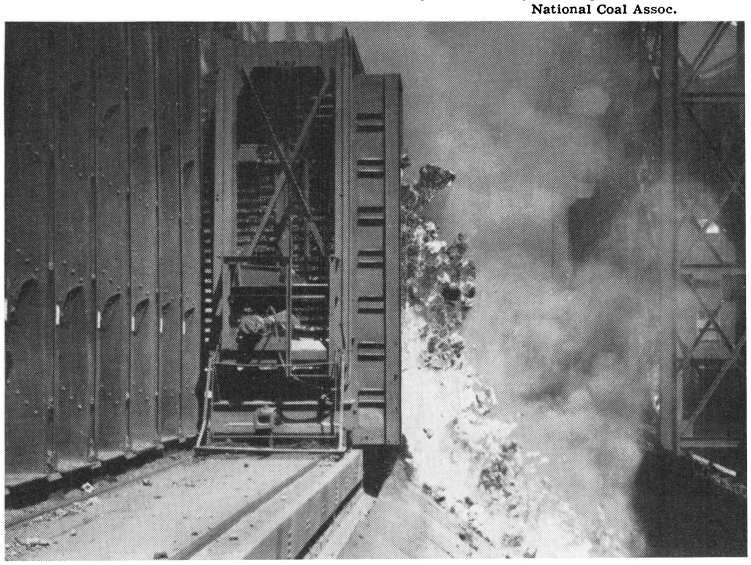
Heating purposes
- Homes
- Industry

Sulfur
- Fungicides
- Insecticides
- Sulfuric acid

Cyanogen
- Cotton finishing
- Dyes

COAL TO STEEL

White-Hot Coke made from coal is dumped into a "hot car" for shipment to quenching towers.
National Coal Assoc.



Some high-rank coal, especially coking coal, is less plentiful than other types. But much non-coking coal can be adapted for coking by processes such as crushing and removing impurities. By blending non-coking coal with coking coal and improving blast furnace methods, steelmakers can reduce the amount of coking coal needed to produce a ton of steel.

Conservation has been aided by the shift from beehive coke ovens to by-product coke ovens. The beehive ovens wasted coking by-products, but the by-product ovens save them.

Advances in transportation have increased coal-mining activity west of the Mississippi River. Coal pipelines, unit trains, and transmission of high-voltage electricity generated from coal at the mines enable Pacific Coast consumers to use coal that comes from the Rocky Mountains.

How Coal Is Used As Fuel

Coal supplies the fuel used to generate over half the electric power in the United States. The coal is burned under boilers containing water. Steam from the boiling water spins turbines which turn generators to produce electricity. One ounce (28 grams) of coal makes as much electricity as 100 short tons (91 metric tons) of water falling 1 foot (30 centimeters). The electric-utility industry uses about 300 million short tons (270 million metric tons) of bituminous coal a year. The aluminum industry, which consumes large quantities of electricity, is building plants in coal regions. This puts the plants close to low-cost sources of electric energy.

Steel is not usually made in large amounts without coke, which is bituminous coal with the tar and gases baked out. Imagine what life would be like without steel. There would be no automobiles, airplanes, trains, ocean liners, or skyscrapers. The U.S. iron and steel industry uses about 80 million short tons (73 million metric tons) of coal annually.

Coal is also widely used as a source of power and heat by other important industries. These include the chemical, cement, paper, and metal industries. Coal is also burned to provide the heat needed for many schools, hospitals, hotels, and apartment buildings.

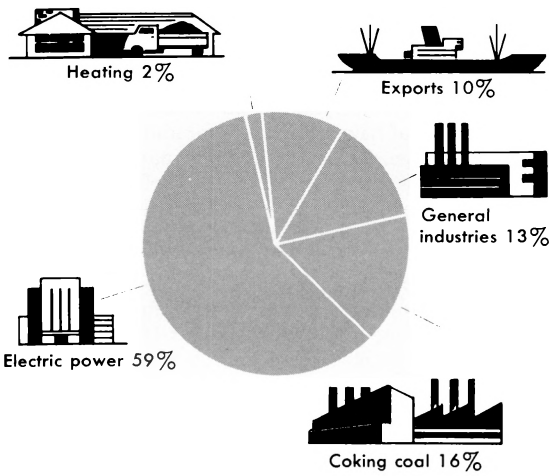
Coal is necessary even for the production of atomic energy. Millions of tons of coal are used each year to make the electricity needed to run United States uranium enrichment plants.

Products from Coal

You use coal every day, although you may not recognize the coal as fingernail polish, a doll, moth balls, or the detergent with which you wash dishes. Chemicals obtained from coal are used to make these and thou-

USES OF BITUMINOUS COAL IN THE U.S.

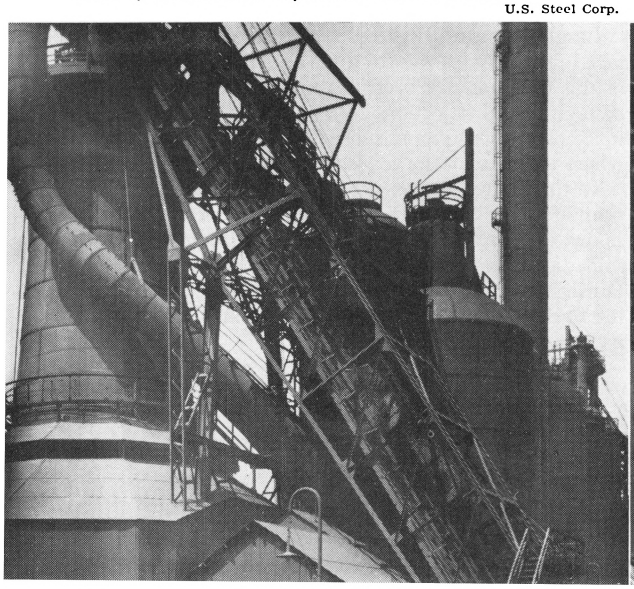
Total bituminous coal consumed or exported in 1971—550,859,000 short tons (499,731,000 metric tons)



Sources: *International Coal Trade*, Feb. and Apr., 1971, U.S. Bureau of Mines

For every 63 short tons of bituminous coal mined, only about 1 short ton of anthracite is mined.

In Making Steel, "skip cars" carry coke, iron ore, and limestone up inclines to be deposited in a blast furnace.
U.S. Steel Corp.



Pig Iron From the Blast Furnace is poured into an open hearth furnace for further refining. Temperatures may reach 3000° F.
Bethlehem Steel Corp.

sands of other useful articles. Four of the main processes used to obtain valuable man-made products from coal are described below.

Carbonization consists of baking coal in an airtight oven. In this process, about two-thirds of the coal is changed into either *coke* or *char*, depending on the quality of the coal baked. Coke is particularly useful in making iron and steel, and as an industrial fuel. One-third of the coal baked turns into tar and gas. Coal tar is used in road surfacing and as a raw material that can be broken down into hundreds of useful chemicals. Coal gas, or coke oven gas, is used as a fuel gas and as a raw-material source of dyes and other industrial chemicals.

Hydrogenation is a process of treating coal with oil and hydrogen under heat and pressure, then separating the liquid mixture into useful products. Hydrogenation produces hydrocarbon gases such as ethane, propane, and butane. It produces low-priced pitch. And it turns out many valuable chemicals such as benzene, phenol, naphthalene, and aniline. These chemicals in turn are used to make everyday products such as dyes, perfumes, paints, and plastics. The hydrogenation process also can be used to produce fuel oil and gasoline. The first commercial use of the hydrogenation process in the United States was in 1952 at a plant built in West Virginia by the Union Carbide & Carbon Corporation. See HYDROGENATION.

Gas Synthesis, or the Fischer-Tropsch process, is a method of developing chemicals from coal by oxidation. The first step is to turn pulverized coal into a gas by exposing the coal to oxygen and superheated steam. The gas, a mixture of carbon monoxide and hydrogen, in turn is passed over various solid catalysts to change it into useful products. Cobalt catalysts have been used to change the gas into diesel fuel. Iron catalysts can change it into gasoline.

Gasification. In the 1970's, the growing shortage of clean-burning natural gas prompted new research into making gas from coal. Both the federal government and private industry sponsored attempts to develop (1) a high heat value gas that could be sent through pipelines and replace natural gas for home heating, and (2) a low heat value gas that could be used to fuel electric power plants. The latter gas would be cheaper, but could not be transported by pipeline.

Basically, coal is converted to high heat gas by burning coal in a closed vessel and blowing oxygen and steam through it to produce methane, the principal ingredient of natural gas. By 1973, two pilot plants were producing high heat gas, and additional plants were planned for the 1970's and 1980's. Pilot projects to produce low heat gas were also planned for the 1970's.

Older methods of coal gasification are used in some steelmaking and other manufacturing plants. However, older methods contribute to air pollution and produce only low heat gas. Two commercial methods are described in the article GAS (How Gas Is Manufactured).

Leading Coal Companies

Most mines are primarily owned by companies in the coal business. But some coal mines belong to steel companies, utilities, and other large industries that use a great deal of coal. These mines are called *captive mines*. Captive mines account for about 13 per cent of the coal produced in the United States.

The United States Steel Corporation is the largest captive mine owner in the United States. Its mines produce about 3 per cent of the total coal production in the United States. Peabody Coal Company of St. Louis and Consolidation Coal Company of Pittsburgh are the two largest owners of noncaptive mines and the two leading coal producers in the United States. Each mines about 10 per cent of the total U.S. coal production. Other large companies include the Island Creek Coal Company of Cleveland and the Pittston Company of New York City. Most major U.S. coal-producing and coal-sales companies work together through the National Coal Association of Washington, D.C. The association provides services in such fields as economics and transportation, government relations, law, marketing, public relations, and research.

Problems of the Coal Industry

The production and use of coal create several environmental problems. For example, strip mining clears away trees and plants that make the soil productive. Burning coal for heat and electric power causes air pollution by releasing solid particles and harmful sulfur dioxide into the air. Solving these problems has become a major challenge for the coal industry.

Several devices have been developed to control the emission of soot and ashes that come from the smokestacks of factories that burn coal. Such devices include filters that trap particles and equipment that washes out particles with chemical sprays. Reducing sulfur dioxide presents a more difficult problem. Several control systems have been developed, but their effectiveness on a long-term basis has not yet been established.

The federal government and many state governments have passed laws dealing with coal mining and coal burning. Most coal-mining states, for example, set restrictions on strip mining and require that land be made productive again after it is mined. The federal Clean Air Act of 1970 sets limits on the amount of sulfur dioxide that can be released from factories and power plants. Some coal deposits contain more sulfur than others. In some cases, coal-burning factories cannot meet anti-pollution standards because the available coal contains too much sulfur.

Large deposits of low-sulfur coal lie close to the surface in some states west of the Mississippi River. Much of this coal has not been mined, however, because of environmental objections to strip mining. In addition, it is costly to transport such coal to Eastern markets, where the demand for low-sulfur coal is highest.

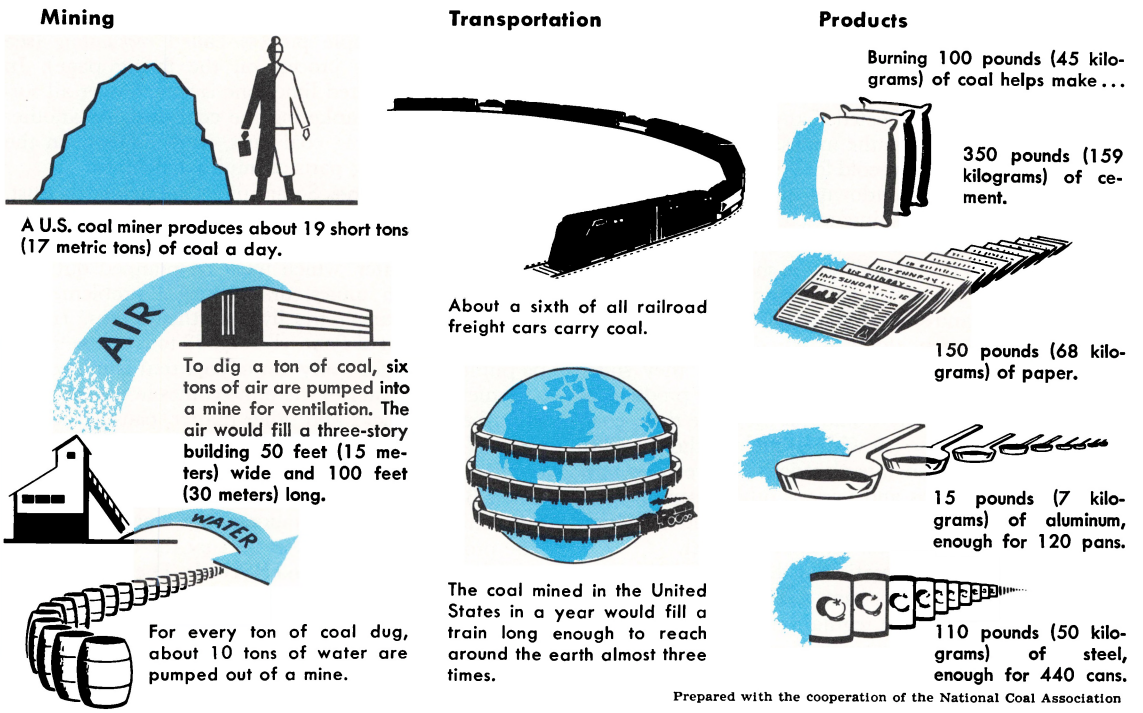
In the United States, coal reserves are much greater than are reserves of oil and natural gas. For this reason, many scientists believe that gas made from coal will someday replace natural gas as a major source of energy. During the 1970's, the coal industry has been attempting to develop efficient methods of converting coal into a clean-burning gas.

The Mining Industry

Employment. The use of coal mining machines has made it possible for a far smaller number of miners

FACTS ABOUT COAL

The burning of coal provides energy to generate the electricity that runs machines. The machines turn out many products that people use daily. This diagram illustrates some interesting facts about the mining of coal and the wide uses of one of man's most valuable natural resources.



Prepared with the cooperation of the National Coal Association

to produce the coal the nation uses. For example, in 1923 more than 700,000 miners were employed in bituminous-coal mines of the United States. They produced about 565 million short tons (510 million metric tons) of coal. In the early 1970's, about 140,000 bituminous miners produced about 603 million short tons (547 million metric tons) of coal. Bituminous-coal mining employed about 12 times as many men as anthracite mining.

The United States coal miner produces more coal per day than does the average miner of any other country in the world. Bituminous miners in the United States mined an average of 19 short tons (17 metric tons) per man every working day in the early 1970's, compared with an average of 3 short tons (2.7 metric tons) per miner in Europe.

Thousands of persons in the United States earn their living directly from the coal industry. About 140,000 miners work in bituminous coal mines. In addition, thousands of people work outside the mines in management, and in selling coal, transporting it, and handling it in coal-using industries.

Working Conditions. Before 1898, the length of the work week in the bituminous-coal mines of the United States was 60 hours. It was reduced to 52 hours during the period from 1898 through 1916, to 50 in 1917, to 48 between 1917 and 1932, and to 40 hours in 1933. Except for a few years during World War II, the 40-hour weekly schedule—eight hours per day and five days per week—has remained in effect.

Weekly work schedules in the anthracite industry remained at 60 hours until April 1, 1903, when they were reduced to 54. A reduction from 54 hours per week to 48 took place on April 1, 1916, and from 48 hours to 35 on May 1, 1937.

During World War II, most miners worked long hours of overtime, but today the normal time worked by miners is 40 hours a week. Miners in the United States usually work about 220 eight-hour days a year.

In early days, coal-mining companies built many *company towns* to provide housing for their miners, and ran *company stores* to supply the miners' needs. This was considered necessary because mines were often located in areas far from cities and towns. There were several disadvantages in the company-town system. The miners sometimes felt that they were not free to live and to buy their goods where they pleased. As retail merchants and landlords, the mining companies had a heavy responsibility to the miners. The introduction of good roads, the automobile, and higher pay made it possible for many miners to live at a distance from the mines. This brought about a decline in company towns.

Unions. Most of the coal miners belong to the United Mine Workers of America. Under the leadership of John L. Lewis, this union became one of the strongest labor organizations in the United States. Lewis, who started working as a coal miner at the age of 12, became president of the United Mine Workers in 1920. He served as president of the union for the next 40 years, until he retired in January, 1960.

The union negotiates contract agreements with the mine operators. These agreements deal mainly with wage rates, hours of work, working conditions, and the royalties paid by the operators into the miners' welfare and retirement fund. This fund provides pensions for retired miners, medical care for miners and their families, and death benefits for miners' families.

Importance to Other Industries. All industries are likely to be seriously affected if anything interrupts the steady flow of coal from the mines. For example, if the great steel furnaces grow cold for lack of coal, a shortage of steel may cause shutdowns in automobile plants, building construction, shipyards, and hundreds of other manufacturing industries. All other industries may be greatly hampered, not only by a shortage of coal for their own use, but also by a shortage of automobiles, new buildings, and ships. Shutdowns spreading to these other industries may throw hundreds of thousands of persons out of work, with the result that they suffer hardships and cannot buy as much of the products of industry as they usually would. At the same time, coal-heated homes may be left without fuel. Without coal to provide energy to generate electricity, entire cities may be cast into darkness and various other essential community services may be cut off. Radio and television stations may go off the air for lack of power.

Thus, the normal operation of the coal industry is of great importance to the country. This is especially true in wartime. Government regulation of the coal industry in the United States was introduced in 1917, during World War I, but government restrictions were removed after peace was declared.

Regulation was revived in 1933. The federal government established minimum prices for coal and aided in the negotiation of wage-hour agreements. This type of regulation was discontinued in 1943 when wartime regulations setting maximum prices were in effect. Since 1946 little regulation has existed except for a time after the start of the Korean War. During several earlier periods of national emergency, the federal government took over operation of the mines when labor-management disputes interfered with coal production.

Mine Safety Measures

Protection Against Gases. Precautions must be taken in mines to detect and control methane gas, which is highly explosive. Explosions may result when the air contains as little as 5 to 15 per cent methane. Methane is formed by the same chemical changes that produced coal from organic matter. For this reason, it is found in coal mines more often than in any other type of mine.

The federal Coal Mine Health and Safety Act of 1969 requires that a mine be closed if it has $1\frac{1}{2}$ per cent or more of methane in the air. Mines are required to test the methane level with an electrical methane-detecting device. Methane can be cleared out of mines with huge ventilating systems. Other gases are also present in most mines. But the ventilating systems used to reduce methane eliminate the other gases before they accumulate in deposits that are large enough to be harmful.

Protection Against Coal-Dust Explosions. Gas explosions in mines are usually confined to one part of the mine, and are not themselves the cause of widespread injury or loss of life. But gas may start much-feared coal-dust explosions. Under certain conditions, coal dust is highly explosive.

The breaking of the coal for loading into mine cars or onto conveyors results in the formation of many fine particles of coal dust. This coal dust can be made harmless by a simple process called *rockdusting* (see the picture of this process on the facing page). In this process, powdered limestone is spread over all surfaces, effectively blanketing the coal dust. As another means of eliminating coal dust, water is used on the cutting and loading parts of mining machines.

Draining the Mine. Some mines are as dry as dust. But others, especially those located far below surface or under subterranean streams, are flooded with large quantities of water, which must be pumped out constantly. In such mines, drainage is a problem, and water may endanger the lives of the miners. In the anthracite region of Pennsylvania, 33 tons of water may be pumped out for every ton of coal that is mined.

Sometimes, water in the mine comes in contact with sulfur-bearing rocks and other matter, causing acid to form. When this water is pumped from the mine, it may pollute nearby streams and water supplies. The United States Bureau of Mines conducts a research program to solve this problem in abandoned and operating mines. The program is financed in part by the coal industry.

Protection Against Other Hazards. The greatest number of injuries in coal mines are caused by material falling from the mine roof. However, steel roof bolts which bind together the overlying layers of rock are used in most underground mines to prevent accidents. Steel and reinforced concrete pillars are sometimes used in main haulageways.

Breathing high concentrations of extremely fine coal dust for several years can cause a disease known as *pneumoconiosis*. This disease, also called *black lung*, occurs when tiny coal particles coat the lungs of miners and interfere with breathing.

Safety Education. Coal mining today is safer than ever before. Some of this improvement has resulted from the development of improved safety devices, but safety education has also played an important part. Many mines have a safety director who meets regularly with the mine foremen and with employee groups to discuss safety measures. A single violation of the no-smoking rule may cause a disastrous fire or explosion. Failure to support the roof properly at a particular spot in the mine may cause a cave-in, trapping scores of miners. A good safety record depends on the cooperation of the mine operator and the miners in following safety measures. Many mines insist on giving their miners "pep talks" on safety practices. The talks concern the need for no-smoking rules and various other measures to insure greater safety for the miners. Posters placed at various locations about the mine warn the workers of the possibly disastrous results if they do not follow safety regulations exactly. Operators' associations and labor unions also aid in safety work and instruction of miners. Nearly all mine accidents could be prevented if safety regulations were followed.

Government Regulation. The United States Bureau of Mines, founded in 1910, studies the hazards of mining and advises mine operators on measures that may

MINING IN SAFETY

Mine Safety Team practices carrying miner on stretcher. A few minutes more or less in a mine disaster may mean many lives saved or lost.

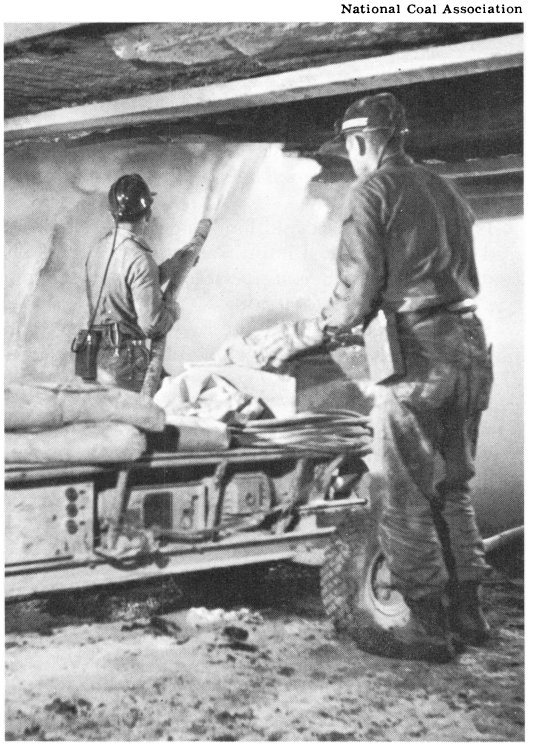
Pittsburgh Consolidation Coal Co.

Bituminous Coal Institute

Mine Inspector checks amount of air being blown through mine to see if men are getting enough air to breathe.

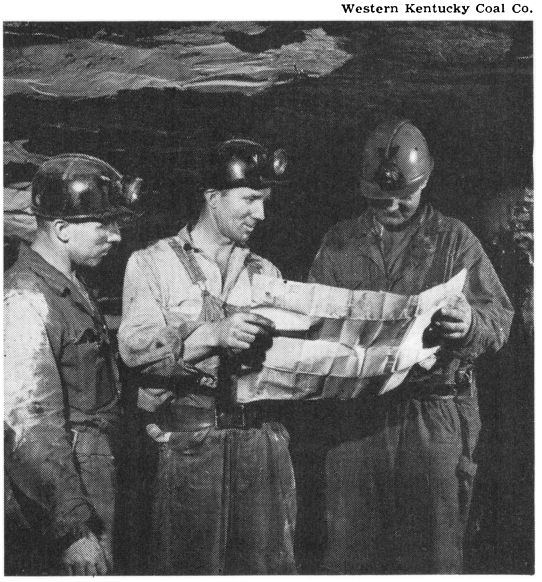
Rockdusting, coating the surfaces of a coal mine with finely powdered limestone, reduces the danger of a minor gas explosion igniting the highly explosive coal dust.

National Coal Association



Safety Engineers talk over each mining operation with foremen and supervisors. A supervisor for each 10 to 12 miners helps to ensure safety in the mines.

Western Kentucky Coal Co.



be taken to prevent accidents. The bureau also administers federal laws pertaining to mine safety. Departments of mines in individual states, acting under state laws, have set up safety standards and regulations that also help reduce the accident rate.

The Federal Coal Mine Health and Safety Act of 1969 established uniform standards for mine ventilation, coal-dust concentration levels, roof support, mine inspections, and equipment. According to this law, miners must be given medical examinations at their employer's expense. The law also provides for regular payments from the United States government to miners who cannot work because they suffer from pneumoconiosis.

History of the Use of Coal

Early Use. The exact date of the first use of coal is not known. There is evidence that 3,000 to 4,000 years ago, in the Bronze Age, the people of Glamorganshire, Wales, used coal for funeral pyres to burn their dead. The Chinese probably used coal about 1,100 years before the Christian Era. King Solomon was probably familiar with the coal deposits of Syria, for coal is mentioned in the Book of Proverbs (26:21). It is also referred to in several later books of the Bible.

The Greeks used coal several hundred years before the birth of Christ. Aristotle, the Greek philosopher, mentioned it in his writings. But hundreds of years passed before coal had any great and lasting influence on the course of civilization.

Use in England. During the Middle Ages in England, coal was commonly thought to be a curse. People thought it filled the air with dangerous poisons that injured people's health. In 1306, King Edward I of England issued a proclamation that declared the use of coal punishable by death. At least one man was put to death for breaking this law. In early days, the methods of burning coal were so inefficient that smoke and bad odor filled the air. Many persons doubted that coal could ever be used successfully. The English were the first people to see the commercial value of coal and to use it widely.

The Industrial Revolution, which dates from the mid-1700's in Great Britain, was largely dependent on coal as the chief source of power to drive steam engines. See INDUSTRIAL REVOLUTION.

The word *coal* as used in the English language comes from the Anglo-Saxon *col*, which originally referred to charcoal. The spelling *cole* was used until about 300 years ago, when the present spelling of the word was adopted.

North America. Coal was discovered in North America in 1679. Father Louis Hennepin, a member of an early French exploring party, observed the black mineral along the Illinois River at a point about 80 miles (130 kilometers) southwest of the present city of Chicago. Some of the American Indian tribes, however, knew about coal long before this time. The Pueblo Indians of the Southwest used coal in their pottery-making at an early date.

A colony of Huguenots, near what is now Richmond, Va., found a few pieces of bituminous coal near their colony in 1700. Fifty years later, a boy hunting crawfish discovered a rich bed in the region, and, before the end of 1750, mining operations were started. This was the first commercial mining of soft coal on the North American continent. In 1759, mining began in western Pennsylvania, and anthracite, now considered one of the finest of fuels, was discovered in eastern Pennsylvania in 1791. For a time this coal was believed to be useless. In some places the sale of anthracite was declared a fraud which was punishable by law.

With growing industrialization, especially after 1850, coal was increasingly used in the United States. The growth of railroads gave the coal industry one of its largest customers, and also stimulated the iron and steel industry, another large user of coal. In the 1890's, the development of steam-driven electric generators sparked the growth of the electric-power industry, the modern coal industry's largest customer.

During the 1960's, the U.S. government and the coal industry worked together in developing new uses of coal. Experimental projects included producing gasoline and pipeline gas from coal.

In recent years, oil and natural gas have been making an increasing contribution to America's fuel consumption, especially in transportation and home heating. All these fuels may eventually feel the impact of competition from atomic energy.

Critically reviewed by NATIONAL COAL ASSOCIATION

Related Articles in WORLD BOOK include:

SOME COAL PRODUCTS

Aniline
Aspirin
Benzene
Carbolic Acid
Carbon
Coal Tar
Coke
Coke Oven Gas
Creosote
Dyes and Dyeing
Gas (fuel)
Illuminating Gas
Nylon
Perfume
Plastics
Synthetics
Toluene

OTHER RELATED ARTICLES

Damp
Diamond
Frick, Henry C.
Fuel
Hanna, Mark
Heating (Coal)
Hydrogenation
Industrial Revolution
Iron and Steel
Jet
Lewis, John L.
Lignite
Mining
Peat
Power
Safety Lamp
United Mine Workers of America
West Virginia (pictures)

Outline

I. How Coal Was Formed
A. Time of Formation
B. Coal Beds
II. Chief Kinds of Coal
A. Anthracite
B. Bituminous Coal
C. Other Kinds of Coal
III. How Coal Is Mined
A. Mining Methods
B. Underground Mining Systems
C. Breaking Down the Coal
D. Hauling Coal Out of a Mine
E. Sizing
F. Cleaning
G. Grading
IV. How Coal Is Transported
A. Shipping
B. Storing

V. Where Coal Is Found
A. World Coal Fields
B. United States Coal Fields
C. Amount of Coal Mined
D. World Coal Reserves
VI. Conservation of Coal
VII. How Coal Is Used As Fuel
VIII. Products from Coal
A. Carbonization
B. Hydrogenation
C. Gas Synthesis
D. Gasification
IX. Leading Coal Companies
X. Problems of the Coal Industry
XI. The Mining Industry
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B. Working Conditions
C. Unions
D. Importance to Other Industries
XII. Mine Safety Measures
A. Protection Against Gases
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C. Draining the Mine
D. Protection Against Other Hazards
E. Safety Education
F. Government Regulation
XIII. History of the Use of Coal
A. Early Use
B. Use in England
C. North America

Questions

What is a preparation plant?

Why was coal not widely used until long after its discovery?

How and when is coal believed to have been formed in the earth?

How is coal used in the production of nuclear energy?

What, in order, are the four largest coal-mining countries of the world? The four leading coal-producing states of the Union? How much coal is mined each year in the United States?

How long may the coal resources of the United States be expected to last?

What is meant by "hard" coal? "Soft" coal? Where in the United States is anthracite found? What is the chief use of anthracite?

What are coking coals?

What are the chief types of coal mines, and how do they differ?

What are the chief safety precautions which must be taken in coal mines?

What means are used to control methane in the modern coal mine?

What are some of the chief products of coal?

What is the principal means of transporting coal in the United States?

Where did French explorers first discover coal in North America?

Books to Read

ADLER, IRVING and RUTH. *Coal.* Day, 1965. A book for young readers describing what coal is, where it comes from, and how it is changed into a variety of other products.

BUEHR, WALTER. *Underground Riches: The Story of Mining.* Morrow, 1958. This beginning book on mining has some material on coal formation, and a chapter on coal mining.

NATIONAL COAL ASSOCIATION. *Bituminous Coal Facts.* National Coal Association. A biennial report in text and tables of the various aspects of the coal industry.

COAL-DUST EXPLOSION. See COAL (Protection Against Coal-Dust Explosions).

COAL GAS. See COKE OVEN GAS.

COAL OIL. See KEROSENE.

COAL TAR is a thick, black, sticky liquid. It is obtained as a by-product in the manufacture of coke and coke oven gas from soft coal. Coal tar is recovered by partially *condensing* (changing to liquid) the hot vapors from a coke oven or a coal gas producer. Further condensation of the vapors produces light oils, such as *benzene* and *toluene*. Benzene is used as a solvent and in making perfumes and some gasolines, and toluene is used in the manufacture of dyes, paints, explosives, and antiseptics.

Tar acids such as *carbolic acid* and tar bases such as *aniline* are other coal tar products. Carbolic acid and aniline are used to make dyes. *Creosote* and *pitch* are heavy liquid coal tar products. Creosote preserves wood, and pitch is used in the manufacture of roofing materials and paint. Perfumes, dyes, and drugs are made from coal tar products. Sir William H. Perkin, an English chemist, pioneered in coal tar chemistry by making mauve, the first dye. But *petrochemicals* (chemicals made from petroleum) are now replacing coal tar chemicals in industry and chemistry. CLARENCE KARR, JR.

Related Articles in WORLD BOOK include:

Aniline
Aspirin
Benzene
Carbolic Acid
Coal (Products)
Coke
Coke Oven Gas
Creosote
Distillation
Dyes and Dyeing
Naphtha
Perfume
Perkin, Sir William H.
Phenacetin
Pitch
Toluene

COALITION, *KOH uh LISH un,* is a combination of members of several political parties to run a country's government. A coalition is often used as a way of getting all parties to work together in a national emergency. During World Wars I and II, the British government was run by such a coalition. Coalition governments are most common in countries where there are many political parties and where a single party seldom wins a majority in the legislature or parliament. The term *coalition* is also used to describe an alliance of several nations against other countries. Coalitions of nations are often formed shortly before or during wars. Many European countries formed coalitions against France during the time of Louis XIV and during the Napoleonic wars. World Wars I and II were fought between coalitions of nations. ERIC SEVAREID

See also POLITICAL PARTY (Multiparty Systems).

COANDA, HENRI MARIE (1885-1972), a civil aeronautics engineer and inventor, designed an airplane based on a jet-propulsion system. He crashed in it on takeoff near Paris in 1912. Coanda also developed a disk-shaped craft, based on an aerodynamic principle called the Coanda effect. Coanda was born in Bucharest, Romania. He studied at various schools, including the École Supérieure de l'Aéronautique. His other inventions include a device that is able to convert salt water to fresh water by using the energy of the sun. R. T. ELLICKSON

COAST. See OCEAN (The Changing Shoreline).

COAST AND GEODETIC SURVEY. See NATIONAL OCEAN SURVEY.

UNITED STATES COAST GUARD

U.S. Coast Guard

The Coast Guard patrols waterways in such vessels as the cutter *Sherman, above.* The Coast Guard protects U.S. ports and ships, performs rescue operations, and carries out many other duties.

COAST GUARD, UNITED STATES, is a branch of the armed services. It also serves as the chief agency for protecting life and property at sea and enforcing United States maritime laws. It fights smuggling, protects ships and ports, and rescues victims of sea disasters. Coast Guard ships patrol United States waterways hunting icebergs, gathering weather information, and guiding ships. In peacetime, it operates as a branch of the Department of Transportation. In time of war, the Coast Guard becomes an active part of the United States Navy. The Coast Guard's many duties give special meaning to its motto, *Semper Paratus* (Always Ready).

The Coast Guard is the nation's oldest continuous sea-going force. Since 1790, it has grown from a fleet of 10 cutters to an efficient force of ships and airplanes. Coastguardsmen have fought in every war of the United States. They have rescued hundreds of thousands of men, women, and children from disasters, and have saved billions of dollars' worth of property from shipwrecks and floods. To perform their heroic work, coastguardsmen have gone to sea under the worst possible conditions. The many risks and dangers they face have led to the saying among coastguardsmen that "You have to go out, but you don't have to come back."

The Coast Guard has a peacetime strength of about

Admiral Willard J. Smith, the contributor of this article, is Assistant Secretary, United States Department of Transportation, and former Commandant of the United States Coast Guard.

U.S. Coast Guard

Coastguardsmen learn the skills of a sailor. They plot ships' courses, *far left,* and pilot ships at sea, *center and near left.*

35,000 active and 32,000 reserve members. The Coast Guard emblem was adopted in 1927. "Semper Paratus" is the Coast Guard's famous marching song, and blue and white are its official colors.

What the Coast Guard Does

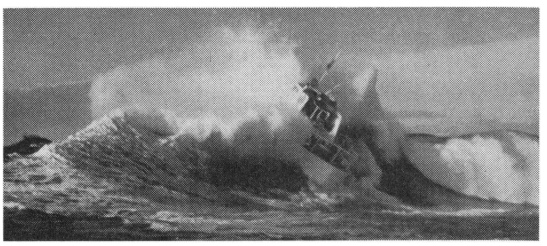
Protecting Life and Property. The Coast Guard has world-wide duties. Its ships, called *cutters*, patrol waterways. Its life-saving stations stand ready for emergencies. When accidents occur, rescue boats and aircraft go into action immediately. They rescue shipwrecked persons, search the waters for survivors, and tow damaged vessels to shore. The Coast Guard gives rescue assistance to any person or ship, regardless of nationality. It provides emergency medical aid to crews of all vessels at sea, and takes injured or critically ill seamen to shore bases for treatment. It also sends boats and men to help in relief operations.

COAST GUARD, UNITED STATES

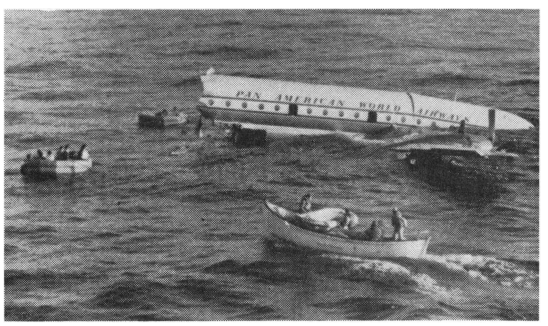
Ships at sea depend on Coast Guard aids to navigation. Such guides as beacons, buoys, fog signals, lighthouses, lightships, and radio stations reduce the dangers of navigation. Loran stations use electronic devices to help ships determine their exact positions at sea (see LORAN). Coast Guard cutters report weather information to the U.S. National Weather Service, which makes these data available to ships and planes. Icebreakers clear clogged harbors on the North Atlantic coast and on inland lakes, rivers, and canals. The International Ice Patrol, operated by the Coast Guard, locates icebergs in shipping lanes in the North Atlantic and warns ships about them. The Alaskan Patrol offers protection in remote Arctic regions. The Coast Guard's port-security program helps keep dangerous persons or cargoes from entering the United States.

Rescue Missions at Sea rank among the chief duties of the Coast Guard. Coastguardsmen use quick communications and a variety of vessels to help in the rescue of shipwreck and airplane crash survivors. They proudly live up to their motto, *Semper Paratus* (Always Ready).

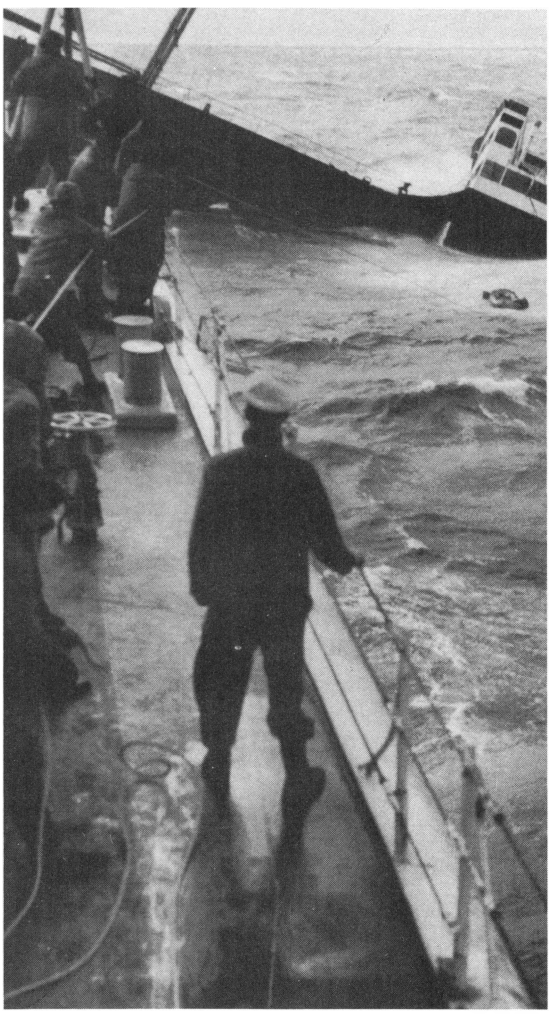
Radiomen Listen for Distress Signals from the Sea.



A Motor Lifeboat Battles Rough Water During a Rescue.



Coast Guard Lifeboats Pick up Plane Crash Survivors.



U.S. Coast Guard

Cutter Crewmen Haul in Survivors of a Shipwreck.

U.S. Coast Guard

A Coast Guard Boat Races to the Rescue and a crewman stands ready to toss a lifesaver to a person in danger of drowning.

Enforcing Sea Laws. The Coast Guard is responsible for enforcing all federal laws on the high seas and on the navigable waters of the United States. These include criminal laws, revenue and navigation laws, and nautical rules of the road. The Coast Guard is responsible for safety regulations for constructing and operating merchant ships. It signs crews on and off ships, and fixes safety rules for passengers and crewmen. The Coast Guard also establishes safety standards for yachts, motorboats, and other noncommercial vessels. The Coast Guard Auxiliary, a voluntary association of yacht and motorboat sailors and owners, promotes safety.

The Coast Guard helps other federal agencies enforce their regulations in all possible ways. It polices oil pollution of waterways, and helps enforce laws concerning customs, immigration, internal revenue, quarantines, sponge-fishing in Florida waters, and the protection of fish and game. Under a program begun in 1963, the Coast Guard coordinates the work of several federal agencies to survey the entire U.S. coastline in order to prevent enemy infiltration.

Supporting the Navy. The Coast Guard stands ready to become part of the United States Navy in time of emergency. It resembles the Navy in organization and training, and cooperates closely with the Navy in many functions. The two services work together in Greenland, Iceland, and other Arctic and Antarctic regions. As part of the Navy in wartime, the Coast Guard maintains a port-security program, provides air-sea rescue services, escorts convoys, and mans troop transports.

Life in the Coast Guard

Training a Coastguardsman begins at "boot camp." The Coast Guard has training centers at Cape May, N.J., and Alameda, Calif., where recruits learn discipline and seamanship. A recruit is called a "boot" because in early days recruits wore leggings that looked somewhat like boots. Recruits receive 13 weeks of basic training. They take courses in communications, fire fighting, first aid, gunnery, military drill, physical education, and seamanship.

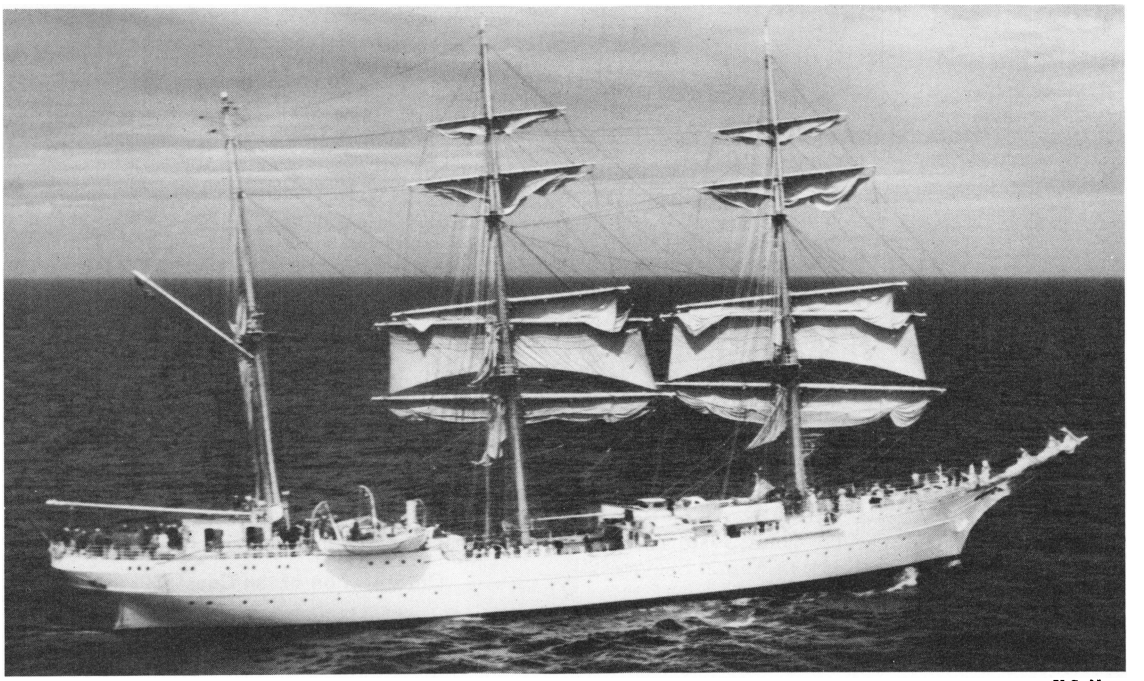
Recruits receive practical training on the drill field, the rifle range, and a 65-foot (20-meter) auxiliary schooner. Specially trained petty officers teach the courses. The Coast Guard also uses Navy materials and facilities in its training program. Coast Guard aviators are trained entirely by the Navy.

The Coast Guard tries to place men in positions for which they are best suited. It encourages them to take specialist courses. The men can earn ratings as electronics technicians, hospital corpsmen, journalists, oceanographers, photographers' mates, radiomen, and in other specialties. For further training, coastguardsmen can take correspondence courses offered by the Coast Guard.

Training an Officer. Most Coast Guard officers receive their training at the U.S. Coast Guard Academy at New London, Conn. A cadet takes a four-year course, and is graduated with a Bachelor of Science degree and

U.S. Coast Guard

Oceanographic Studies are part of the Coast Guard's work. Guardsmen measure the sea's salt content and temperature daily.



U.S. Navy

Coast Guard Cadets train at sea. Cadets at the United States Coast Guard Academy in New London, Conn., receive training aboard the *Eagle*, above, and other ships.

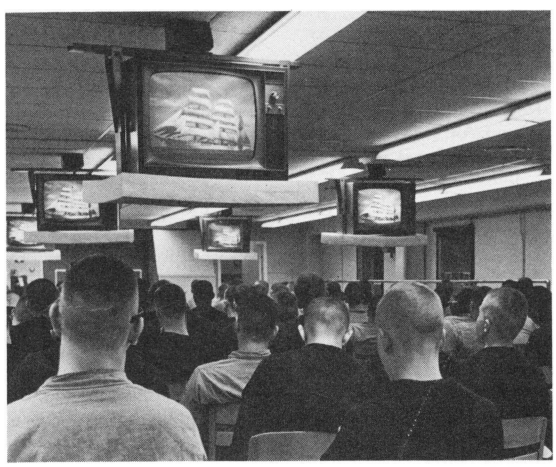
a commission as an ensign in the Coast Guard. The academy organizes cadets into two battalions of four companies each. *First classmen* (members of the graduating class) serve as officers of the battalions. The highest honor a cadet can receive is to be chosen battalion commander in his first-class year. Members of each new class enter the academy during the summer, usually in late June or early July. These fourth classmen are called *swabs*. They spend their *swab summer* becoming adjusted to military life. Coast Guard cadets spend part of each summer at sea, training aboard the bark *Eagle* and on major cutters. See UNITED STATES COAST GUARD ACADEMY.

A man with a bachelor's degree from an accredited college or university may take a special 16-week officer-candidate course at the Coast Guard Academy. Enlisted men with the proper qualifications may also take this course. Upon graduation, the men receive commissions as ensigns in the Coast Guard Reserve. An intensive 12-week officer's training course is open to qualified officers of the merchant marine. These men receive commissions in the U.S. Coast Guard after completing the course.

Careers in the Coast Guard include a variety of challenging positions. A coastguardsman has opportunities to become an expert in a specialized field. Coast Guard training also prepares men for civilian jobs when their enlistments end or when they retire from service. Applicants must be between the ages of 17 and 26. They must meet Coast Guard physical standards, and make a qualifying score on the Armed Forces Qualifications Test. Applicants may have no more than one dependent.

Applicants to the Coast Guard Academy must be high school graduates between 17 and 22 years old. They must be unmarried, meet rigid physical standards, and be of good moral character. Cadets are appointed on the basis of a nationwide competition each year. Applications to enter the competition should be sent to the Director of Admissions, U.S. Coast Guard Academy, New London, Conn. 06320.

Officers and enlisted men in the Coast Guard hold the same ranks and earn the same pay as those in the Navy. Coast Guard uniforms are similar to those of the Navy. But a Coast Guard officer wears a distinctive cap device and the Coast Guard shield instead of the Navy



U.S. Coast Guard

Classroom Training includes instruction by television. TV teaches Coast Guard history to recruits at Camp May, N.J., above.

U.S. Coast Guard

Buoy Tenders are a kind of Coast Guard ship. Their crews repair *buoys* (floating markers) and do rescue work in emergencies.

star. An enlisted man wears the Coast Guard shield on his lower right sleeve. See RANK IN ARMED SERVICES.

Ships and Weapons of the Coast Guard

Ships and Stations. The Coast Guard maintains a fleet of several hundred ships and boats that can perform various assignments. These vessels include cutters, fireboats, icebreakers, lifeboats, lightships, motorboats, surfboats, tenders, and tugs.

The service operates more than 50 safety and port-security offices, and about 50 offices devoted to shipping-inspection duties. It also maintains light towers, navigational aids, and over 500 patrol and lookout stations, including more than 160 manned lighthouses.

Aircraft play a major part in Coast Guard operations. The Coast Guard has about a dozen kinds of aircraft for patrol work and extended searches. Coast Guard seaplanes can fly more than 1,000 nautical miles out to sea, land on the ocean, and pick up survivors of sea accidents. Helicopters are particularly important to the Coast Guard. They can rescue disaster victims in inland areas that could not otherwise be reached. The Coast Guard also uses helicopters in air-sea rescues, and in bringing help to flooded areas. During World War II, Coast Guard aircraft bombed submarines and rescued many survivors of torpedoed ships.

Ordnance. About 200 Coast Guard vessels are armed with guns. Weapons range from machine guns on small patrol vessels to 5-inch (13-centimeter) guns on large cutters. Many vessels also carry some antisubmarine warfare weapons. Coast Guard recruits receive small-arms training. The service also has a special training program for crews of small armed vessels. It sends larger vessels to naval training centers for refresher training.

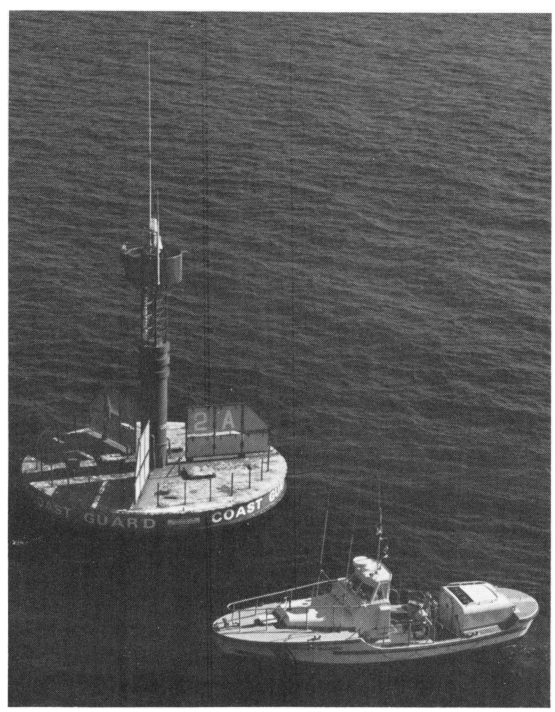
Organization of the Coast Guard

Coast Guard Headquarters are in Washington, D.C. The service operates as a branch of the Department of Transportation in peacetime. In wartime, or upon the direction of the President, it is subject to the orders of the secretary of the navy. The commandant of the Coast Guard heads the service. A vice-commandant, a planning and control staff, and officers of various Coast Guard departments assist him. The United States and its possessions are divided into 12 Coast Guard dis-

MAJOR COAST GUARD INSTALLATIONS

Name	Location
Boston Coast Guard Base	Boston, Mass.
*Cape May Training Center	Cape May, N.J.
Coast Guard Headquarters	Washington, D.C.
Corpus Christi Air Station	Corpus Christi, Tex.
Elizabeth City Air Station	Elizabeth City, N.C.
Governors Island Coast Guard Base and Training Center	Governors Island, N.Y.
Honolulu Coast Guard Base	Honolulu, Hawaii
Kodiak Coast Guard Base and Air Station	Kodiak, Alaska
Miami Air Station	Miami, Fla.
Mobile Coast Guard Aviation Training Center	Mobile, Ala.
New Orleans Coast Guard Base and Air Station	New Orleans, La.
Petaluma Coast Guard Training Center	Petaluma, Calif.
Portsmouth Coast Guard Base	Portsmouth, Va.
St. Louis Coast Guard Base	St. Louis, Mo.
San Diego Air Station	San Diego, Calif.
San Francisco Coast Guard Base and Air Station	San Francisco, Calif.
San Juan Coast Guard Base	San Juan, Puerto Rico
San Pedro Coast Guard Base	Los Angeles, Calif.
Seattle Coast Guard Base	Seattle, Wash.
Traverse City Air Station	Traverse City, Mich.
*United States Coast Guard Academy	New London, Conn.
United States Coast Guard Yard (Curtis Bay)	Baltimore, Md.

*Has a separate article in THE WORLD BOOK ENCYCLOPEDIA.



U.S. Coast Guard

Inspection of Buoys is a job of the Coast Guard. Guardsmen make sure these important aids to navigation are in good repair.

U.S. Coast Guard

Coast Guard Airplanes, such as the Lockheed Hercules four-engine transport, above, are used for long-range patrol and search duty at sea. This plane also helps locate icebergs off Newfoundland.

tricts. Each district is headed by a district commander.

Regulars and Reserves. The *Regular Coast Guard* makes up the core of the service. It consists of officers and enlisted men who have chosen the Coast Guard as a full-time career. The *Coast Guard Reserve* is a supplementary group whose members may be called to active duty in time of emergency. Their training includes electronics, port security, and vessel manning.

Women in the Coast Guard are called SPARS. The name SPAR comes from the first letters of the Coast Guard motto, *S*emper *P*aratus, and its English translation, *A*lways *R*eady. All women in the SPARS serve as reserves. The SPAR organization, established in 1942, reached a strength of 1,000 officers and 10,000 enlisted women during World War II. After the war, the Coast Guard discontinued all SPAR enlistments and training, and officially dissolved the organization. A number of SPARS returned to active duty during the Korean War. A small group of women reserves serves on active duty, most of them at Coast Guard headquarters. See SPARS.

History

The Revenue Marine was created in 1790 at the recommendation of Alexander Hamilton, first secretary of the treasury. Congress established this fleet of 10 small sailing vessels to stamp out smuggling and piracy along the coasts of the United States. Revenue Marine officers had permission to board all vessels that entered United States waters, and to examine their cargoes.

From 1790 until 1798—when the Navy was reorganized—the Revenue Marine served as the nation's only naval force. The service saw its first wartime activity from 1797 to 1800, when it cooperated with the Navy in fighting French privateers. The Revenue Marine also fought during the War of 1812. In 1831, the service began its first winter cruising to aid seafarers and ships in distress. The name of the service was changed to the Revenue Cutter Service in 1863.

New Duties. For many years, private organizations such as the Massachusetts Humane Society operated the

U.S. Coast Guard

Helicopters play an important part in many Coast Guard rescue missions. The helicopter shown above can land on water.

only lifesaving services on the Atlantic Coast. In 1837, Congress authorized the use of public vessels to cruise the coast in rough weather and help navigators in distress. The government took over all privately operated lifesaving stations in 1871 and established the Lifesaving Service, operated by the Revenue Cutter Service. In 1878, the Lifesaving Service became an independent bureau of the Department of the Treasury. The Revenue Cutter and Lifesaving services were combined as the United States Coast Guard in 1915. The Federal Lighthouse Service became a part of the Coast Guard in 1939. The Bureau of Marine Inspection was transferred from the Department of Commerce to the Coast Guard in 1942.

—— IMPORTANT DATES IN COAST GUARD HISTORY ——

1790 The U.S. Congress authorized the construction of 10 cutters for a Revenue Marine service.
1819 Congress authorized revenue cutters to protect United States merchant vessels against piracy, and to seize vessels engaged in slave trading.
1861 The cutter *Harriet Lane* fired the first shot from any vessel in the Civil War.
1863 The name of the service became the Revenue Cutter Service.
1898 The cutter *McCulloch* sent the first news of the victory over the Spanish fleet at Manila Bay.
1915 The Revenue Cutter Service and the Lifesaving Service combined to form the U.S. Coast Guard.
1917 During World War I, the Coast Guard for the first time was ordered to serve as part of the Navy.
1939 The Lighthouse Service of the Department of Commerce was transferred to the Coast Guard.
1945 The icebreaker *Mackinaw* made the first winter trip through the Soo locks on Lake Superior.
1957 The cutters *Storis*, *Bramble*, and *Spar* became the first U.S. ships to complete a trip through the Northwest Passage.
1966 The Coast Guard was transferred from the Treasury Department to the Department of Transportation.

U.S. Coast Guard

An Air-Cushion Vehicle, also called a *Hovercraft,* operates in water or on land. The Coast Guard conducts experiments with these vehicles to test their value in various jobs.

World War I. On April 6, 1917, after the United States declared war on Germany, the Coast Guard's more than 200 officers and 5,000 men were ordered to go into action with the Navy. The Coast Guard served in the thick of the action, convoying cargo ships and screening transports. One of the war's great sea tragedies occurred on Sept. 26, 1917. The cutter *Tampa*, bound for England from Gibraltar, disappeared with a loud explosion. The entire crew of 111 coastguardsmen and 4 navy men was lost. Authorities believe that a torpedo hit the cutter. In proportion to its strength, the Coast Guard suffered greater losses in the war than any of the other United States armed forces.

World War II saw the Coast Guard serving as a specialized branch of the Navy. The service was responsible for handling and stowing explosives and other dangerous cargoes, and for protecting vessels and port facilities from fire, negligence, or damage. The Coast Guard also furnished weather reports, provided cutters for convoy duty, manned its own vessels as well as many of the Army and Navy, took part in Pacific operations, and developed beach-landing methods for the Allied invasion of Europe in 1944.

The Coast Guard Auxiliary was formed in 1939. During World War II, its members offered their boats and their services to the Coast Guard without pay. They wore uniforms and served under military discipline while on duty. The Coast Guard Reserve was established in 1941. During the war, about 10,000 reserve officers and 150,000 enlisted men were on active duty in the Coast Guard.

Recent Developments. In 1957, three cutters, *Storis*, *Bramble*, and *Spar*, were the first U.S. ships to sail through the Northwest Passage, the deepwater passage across the top of North America. They shortened the route large ships must take to reach Baffin Bay and found a sea path that could be expected to be free of impassable ice during the summer. On the voyage, the cutters helped establish the Distant Early Warning (DEW) radar line in that part of the world (see DEW LINE). In the mid-1960's, the Coast Guard began operation of large icebreakers that formerly belonged to the Navy. The icebreakers support the Navy in polar operations. In 1966, the Coast Guard was transferred from the United States Treasury Department to the newly created Department of Transportation.

In 1965, during the Vietnam War, a Coast Guard squadron began patrolling the coastal waters of South Vietnam. The 26 cutters were assigned to prevent the flow of Communist troops and equipment from North Vietnam to South Vietnam.

WILLARD J. SMITH

Related Articles in WORLD BOOK include:

Beacon
Breeches Buoy
Buoy
Flag (color picture: Flags of the Armed Forces)
Floods and Flood Control
Ice Patrol, International
Icebreaker
Lighthouse
Lightship
Loran
National Defense
Navy, United States
SPARS
United States Coast Guard Academy

Outline

I. What the Coast Guard Does
A. Protecting Life and Property
B. Enforcing Sea Laws
C. Supporting the Navy

U.S. Coast Guard

A Modern Coast Guard Cutter, such as the *Vigilant, above,* has a huge deck where helicopters can take off and land. The crew's living quarters are modern and comfortable.

II. Life in the Coast Guard
A. Training a Coastguardsman
B. Training an Officer
C. Careers in the Coast Guard
III. Ships and Weapons of the Coast Guard
A. Ships and Stations
B. Aircraft
C. Ordnance
IV. Organization of the Coast Guard
A. Coast Guard Headquarters
B. Regulars and Reserves
C. Women in the Coast Guard
V. History

Questions

What is the Coast Guard motto? What does it mean?
What law-enforcement duties does the Coast Guard have?
How is the Coast Guard related to the Navy?
What is the *Regular Coast Guard?* A SPAR?
How does the Coast Guard aid navigators?
What kind of training do most Coast Guard officers receive?
What is the International Ice Patrol?
What kinds of services did the Coast Guard perform during World War II?
Why was the Coast Guard's forerunner, the Revenue Marine, established?
How are aircraft important to the Coast Guard?

COAST GUARD ACADEMY, UNITED STATES. See UNITED STATES COAST GUARD ACADEMY.

COAST RANGE is a series of mountains that form the western coast of North America for about 2,500 miles (4,020 kilometers). It extends from Kodiak Island, Alaska, through Canada to southern California. Twelve separate mountain ranges make up this coastal region. The Kodiak, Kenai, Chugach, and St. Elias ranges, and the Alexander Archipelago, a group of islands formed by the tops of sunken mountains, are in Alaska. The Queen Charlotte Islands and the Vancouver Range are in British Columbia. The Olympic Mountains rise in Washington, and the Oregon Coast Range extends from southern Washington to central Oregon. The Klamath Mountains rise in southern Oregon and northern California. The California Coast Range is in central California, and the Los Angeles Ranges rise along the coast of southern California.

The northern coast is sunk in great bays and straits from Shelikof Strait to Puget Sound. The southern coastline is high and regular, broken only by a few harbors. JOHN H. GARLAND

See also UNITED STATES (The Pacific Ranges and Lowlands); OLYMPIC MOUNTAINS.

COASTAL PLAIN. See PLAIN; UNITED STATES (The Coastal Lowlands).

COAT OF ARMS. See HERALDRY.

COATI, *koh AH tee,* or COATIMUNDI, is a member of the raccoon family. It has a long, flexible snout and often carries its long, ringed tail straight up. Coatis live in wooded areas from Arizona southward to northern Argentina. They measure from 16 to 26 inches (41 to 66 centimeters) long, not counting the tail, and weigh from 10 to 15 pounds (4.5 to 6.8 kilograms). Coatis of the dry hills of Arizona have sandy blond fur. Chocolate-brown coatis live in the rain forest of Panama. South American coatis are reddish-brown.

Coatis eat almost anything they can easily find, including insects, land crabs, snails, spiders, and a

Warren Garst, Tom Stack & Associates

The Coati eats insects, spiders, and other small animals that it digs out of the ground with its long, sharp claws.

variety of fruits. They also eat birds' eggs, lizards, and mice.

Coatis move about mostly in the daytime and are at home both on the ground and in trees. They are curious, intelligent animals and continually sniff the air and dig into the ground with their claws as they wander through the woods. Females and young coatis travel in bands of 6 to 20 animals, but adult males live alone. The word *coatimundi* is an Indian term meaning "lone coati," and it actually refers only to the males.

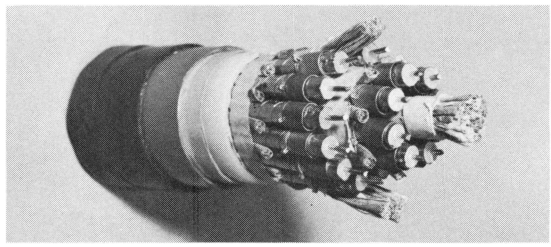
Each year, one male joins each band for the mating season, which lasts about a month. About 10 or 11 weeks after mating, the pregnant females leave the group. They build tree nests of sticks and leaves and give birth to three or four young. About six weeks later, the mothers and their young rejoin the bands. See also ANIMAL (picture: Animals of the Tropical Forests).

Scientific Classification. Coatis form the genera *Nasua* and *Nasuella* in the raccoon family, *Procyonidae*. One species is *Nasua narica*. JOHN H. KAUFMANN and ARLEEN KAUFMANN

COATSWORTH, ELIZABETH (1893-), is an American poet, novelist, and author of books for children. In 1931, she won the Newbery medal for *The Cat Who Went to Heaven*, a poetic story. She was born in Buffalo, N.Y., and was graduated from Vassar College and Columbia University.

COAXIAL CABLE is an electrical conductor that is used to transmit long distance telephone calls; coded, typed, or handwritten information; *facsimile* (electronic copy, such as maps, pictures, and charts); or other communications. It can transmit television programs, but most television is sent by radio relay.

A coaxial cable contains from 8 to 20 *coaxials*. A coaxial consists of a copper tube with a copper wire held in the tube's center by plastic insulators. The tube is $\frac{3}{8}$ inch (9.5 millimeters) in diameter, and the insulators are spaced about 1 inch (2.5 centimeters) apart along the tube. The tube and wire have the same *axis* (center), and are therefore called *coaxial*. The tube shields the signal from outside electrical interference and prevents the signal from losing its strength. The coaxial is wrapped with steel tape for strength, protection, and electrical shielding.



A.T. & T. Co.

A Coaxial Cable includes several tube-encased wires for communications and insulated wires for maintenance and control.

The cable includes several insulated wires, as well as the coaxials. The wires are used for control and maintenance. The cable is wrapped in a plastic and lead sheath. An 8-tube cable is about 2 inches (5 centimeters) in diameter and a 20-tube cable is about 3 inches (8 centimeters) in diameter. Electric signals are sensitive to changing temperatures, so most coaxial cables are buried in the earth, which has a more constant temperature. Amplifiers that strengthen the signals may be placed as close as 2 miles (3.2 kilometers) apart.

Coaxials work in pairs. One coaxial carries signals in one direction, while the other handles signals in the other direction. One pair of tubes in a cable is usually reserved for use in case of damage to another pair.

Today, a pair of coaxials can carry 3,600 separate signals at once. For example, a fully equipped, 20-tube cable, with a pair of tubes in reserve, can carry 32,400 two-way conversations simultaneously.

Two Bell Telephone engineers, Lloyd Espenshied and Herman A. Affel, invented the coaxial cable. The cable was successfully tested in 1936. C. C. DUNCAN

See also CABLE; TELEPHONE; TELEVISION.

COBALT, *KOH bawlt* (chemical symbol, Co), is a tough, silver-white metallic element. The name *cobalt* is from the German word, *kobold*, meaning *underground spirit*. Georg Brandt of Sweden discovered the element in 1737.

Properties. Cobalt has the atomic number 27, and an atomic weight of 58.9332. It resembles nickel and iron in hardness and tensile strength, but it is stronger than iron and does not rust or tarnish. Its density is 8.9 and it melts at 1495° C (2723° F.).

Sources. Cobalt occurs in compounds with arsenic, oxygen, and sulfur, and in ores that bear nickel, iron, copper, lead, and zinc. Large deposits of silver-nickel-cobalt ores are found in the Sudbury District of Ontario, Canada. Deposits also have been found in Zaire, Zambia, and Morocco. There is little cobalt in the United States. Pennsylvania, Missouri, and Idaho have small deposits of cobalt that occur mostly in pyrites.

Uses of Cobalt. Cobalt is chiefly used in alloys, especially in alnico and Stellite. Alnico contains nickel and aluminum, and makes powerful permanent magnets for use in radio, television, and other electronic devices. Stellite contains chromium and tungsten. It is used to make drilling bits and cutting tools that stand considerable wear. Cobalt also goes into alloys used for jet engines and gas turbines, because it remains hard even at temperatures up to 1800° F. (982° C).

Cobalt compounds, such as cobalt blue, ceruleum, new blue, smalt, cobalt yellow, and cobalt green, are used as pigments by artists and interior decorators, and in ceramics. The ceramics industry also uses large amounts of cobalt oxide for tinting glass and enamel. Vitamin B_{12}, an organic compound of cobalt, helps to prevent pernicious anemia (see ANEMIA). A radioactive isotope of cobalt, cobalt-60, has largely replaced radium in the treatment of cancer. It is both cheaper and easier to use than radium. Cobalt-60 also serves as a tracer for following the course of substances through the body. JOHN R. KOCH

See also ALLOY; COBALT-60; COBALT BOMB; ELEMENT, CHEMICAL.

COBALT-60 is a radioactive isotope of cobalt. It has an atomic mass number of 60. Its *half life* is $5\frac{1}{4}$ years. This means that half the atoms in a sample of cobalt-60 will decay to form atoms of nickel-60 in $5\frac{1}{4}$ years. As it decays, cobalt-60 gives off *beta particles* (electrons) and *gamma rays* of high energy. Cobalt-60 can be produced by bombarding atoms of ordinary cobalt with the neutrons in an atomic reactor, or by bombarding nickel or copper in a cyclotron. ROBERT L. THORNTON

See also NUCLEAR REACTOR; COBALT BOMB; CYCLOTRON; RADIOACTIVITY.

COBALT BOMB. When cobalt is placed in an atomic reactor and exposed to neutrons, it becomes radioactive. This radioactive cobalt, cobalt-60, gives off high-energy radiations called gamma rays (see COBALT-60; GAMMA RAY). A cobalt bomb is a device in which cobalt-60 is used to produce an intense beam of gamma rays. It can be used in hospitals for treating cancer, in industry for examining metals for weak spots, and for other purposes where gamma rays are useful. See RADIATION (How Radiation Affects Life on the Earth); RADIOACTIVITY (Uses of Radioisotopes).

The term *cobalt bomb* also refers to an atomic bomb to which cobalt might be added. Scientists have never made such a bomb, but they believe it would produce large amounts of radioactive *fallout* (debris). During an atomic explosion, radioactive cobalt isotopes would be produced and scattered over a large area. A fallout of this kind would create a health hazard, and might prevent occupation of the exposed area for a long period of time. ROBERT L. THORNTON

See also FALLOUT; RADIATION SICKNESS.

COBB, IRVIN SHREWSBURY (1876-1944), an American humorist, was a novelist, short-story writer, dramatist, and newspaperman. He believed that "you had to poke fun at yourself before you could poke fun at anyone else without hurting his feelings." Cobb followed this formula in his humorous stories. He did not begin to publish until he was 37. His popular works include *Old Judge Priest* (1915), *Those Times and These* (1917), *A Laugh a Day* (1923), and his autobiography, *Exit Laughing* (1941).

Irvin Cobb

U&U

Cobb was born in Paducah, Ky., on June 23, 1876. He became the managing editor of the *Paducah News* at 19. Later, he wrote for New York City newspapers as well as for the *Saturday Evening Post*. He also wrote for and acted in motion pictures. FREDERICK J. HOFFMAN

COBB, TY (1886-1961), was one of the greatest baseball players in history. Called the *Georgia Peach*, Cobb was born in Banks County, Georgia. His full name was TYRUS RAYMOND COBB. He began playing baseball for the Detroit Tigers in 1905. He played 24 seasons in the American League, 22 for Detroit, and 2 for the Philadelphia Athletics. He had a lifetime batting average of .367, and stole 892 bases. Cobb was an excellent strategist and a brilliant outfielder. He managed the Tigers from 1921 to 1926. Cobb was elected to the Baseball Hall of Fame in 1936. ED FITZGERALD

See also BASEBALL (picture).

COBBLE. See BOULDER.

COBDEN, RICHARD (1804-1865), was an English manufacturer and statesman who vigorously urged free trade. He believed that eliminating tariffs and other restrictions on trade would improve relations between nations and lead to world peace.

Cobden was born near Midhurst, Sussex. He became a partner in a textile business in 1828. Cobden helped organize the Anti-Corn Law League in 1838. England's corn laws were designed to keep the price of small grains high (see CORN LAWS). He was elected to Parliament in 1841, and helped repeal the corn laws in 1846. He also championed free trade and world peace. Cobden opposed Britain's part in the Crimean War (1853-1856), and this stand contributed to his defeat in 1857. Cobden was re-elected in 1859. VERNON F. SNOW

See also PEEL, SIR ROBERT (Prime Minister).

COBH, *kohv* (pop. 6,076), is a seaport in County Cork in southwestern Ireland. It lies on the south shore of Great Island in Cork Harbor. For location, see IRELAND (color map).

Cobh was built on a hillside in a half-circle facing the harbor. Ships traveling between Europe and the United States often make Cobh a port of call. Thousands of Irish immigrants have sailed to North America from Cobh. Saint Colman's Cathedral overlooks the harbor.

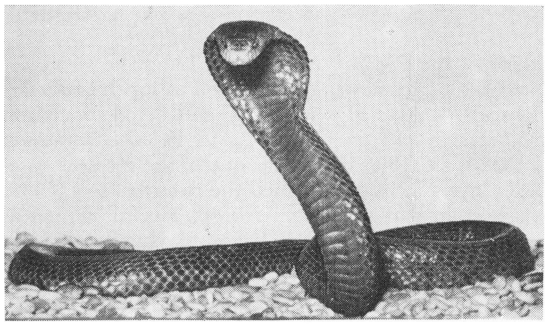
The city was called *Cove* until 1849. Then, during the British occupation of Ireland, it was named *Queenstown* in honor of Queen Victoria. The government renamed it *Cobh*, the Gaelic spelling of Cove, in 1922, after Ireland became free from British rule. T. W. FREEMAN

COBLENZ. See KOBLENZ.

COBOL. See COMPUTER (Writing a Program).

COBRA, *KOH bruh*, is any one of a group of poisonous "hooded" snakes. Cobras are nervous, and, when excited, flatten the neck by moving the ribs. This movement gives the appearance of a hood. In most snakes, the neck ribs are shorter than those farther back. But in cobras with large hoods, the neck ribs are the longest. These ribs are almost straight instead of curved like those of the body.

Cobras use their deadly poison in two ways. Some types bite their victims with poison fangs in the front of the upper jaw. Others also squirt the poison directly at the eyes of the victim. In these kinds, the fangs are shaped so that the poison is sent forward when the cobra tilts back its head. This is called "spitting,"



Zoological Society of Philadelphia

The Spitting Cobra of Malaya can squirt poison directly at the eyes of its victim. The venom may cause blindness if it is not washed out immediately.

and is most highly developed in two African cobras and one East Indian. The venom does not harm humans unless it gets into their eyes. It causes severe irritation and even blindness if not washed out immediately. The bite may cause death in a few hours.

A full-grown Indian cobra is nearly 6 feet (2 meters) long, and about 6 inches (15 centimeters) around. Its color ranges from yellowish to dark brown. On the back of its hood it has a mark like a pair of spectacles. It is sometimes called "spectacled cobra."

Most cobras eat many kinds of animals, such as frogs, fishes, birds, and various small mammals. A dangerous enemy of the cobra is the tiny mongoose. This animal attacks and usually kills the snake. See MONGOOSE.

Cobras live in Africa, Southern Asia, and the East Indies, including the Philippine Islands. The *king cobra* of southeastern Asia is by far the largest of the group, and the longest poisonous snake known. It reaches a length of 18 feet (5.5 meters). It has a narrow hood. Most king cobras retreat from men and will attack only when they are surprised while guarding their eggs.

Cobras are found in various types of country, and may even enter houses. Cobras are not so dangerous as generally believed, because of the way they attack. They prepare for battle by lifting up the front of the body without curving it like an S. An opponent can well judge how far a forward jab will reach. The S-curves of the rattlesnake and other vipers make the reach hard to judge. The cobra moves slowly compared to some snakes. A person can easily knock down a rearing cobra by swinging a level stick. The cobra's fangs do not deliver the poison nearly so well as the viper's. The cobra's are shorter, and cannot be folded back. But cobras often chew an object after they have seized it. This habit helps inject the poison.

The jugglers and snake charmers of India usually use the cobra because of its unusual hood and its nervous disposition. These men pretend to charm snakes with music. But snakes are deaf, and when they are being "charmed" they are only holding themselves on guard. They would do the same thing without the music.

Scientific Classification. The cobras belong to the terrestrial poisonous snake family, *Elapidae*. The Indian cobra is genus *Naja*, species *N. naja*. The king cobra is *Naja hannah*. CLIFFORD H. POPE

See also ASP; SNAKE (color pictures: Indian Cobra, Indian Snake Charmer); SNAKE CHARMING.

COBWEB. See SPIDER (Tangled-Web Weavers).

COCA, *KOH kuh*, is one of a group of South American shrubs or small trees. Coca trees grow about 3 to 7 feet (0.9 to 2.1 meters) tall. The Huanuco coca is a greenish-brown plant with shiny, thick stems. The leaves are about 1 to 3 inches (2.5 to 7.6 centimeters) long with smooth edges. The Truxillo coca is pale green and has smaller leaves that smell like tea leaves. The leaves of both plants taste bitter and produce a numbness of the tongue and lips when chewed.

The dried leaves of coca plants contain several drugs used in medicine, including cocaine, tropacocaine, and hygrine. The Indians of South America chew coca leaves with lime. The drugs in the leaves keep them from feeling tired or hungry, but they do not nourish the body. After a time, the chewing of these leaves becomes habit-forming, and ruins the health of the person.

Scientific Classification. Coca plants belong to the coca family, *Erythroxylaceae*. They are classified as genus *Erythroxylon*, species *E. coca*. HAROLD NORMAN MOLDENKE

COCA-COLA COMPANY. See SOFT DRINK.

COCAINE is a powerful drug made from the leaves of the coca shrub. It relieves fatigue and provides a feeling of well-being. Physicians once used cocaine as an anesthetic. Procaine, a safer, man-made drug, has largely replaced cocaine in medical use. Cocaine is strongly habit-forming, and its regular use produces mental confusion. The U.S. government forbids the drug's sale and use, except by a physician's prescription.

Some people use cocaine illegally to get the feelings of energy, excitement, and happiness that the drug can produce. Cocaine users inject, sniff, or swallow the drug. Cocaine improves a person's mental and physical effort for a while. But after this effect wears off, the user can become so depressed that he may take another dose. Repeated use of cocaine causes a strong psychological craving for it. Many scientists do not believe the drug produces physical dependence, as heroin does.

The repeated use of cocaine makes a person suspicious and fearful. A constant user sees and hears things that do not exist. He believes he has special mental powers and enormous physical strength. Influenced by these beliefs, he may harm himself or others. Prolonged use of cocaine also causes nausea, sleeplessness, and loss of appetite and weight. DONALD J. WOLK

See also DRUG ABUSE.

COCCOSPHERE. See PLANKTON.

COCCUS. See BACTERIA (Shapes of Bacteria).

COCCYX. See SKELETON (The Axial Skeleton).

COCHABAMBA, *KOH chah VAM bah* (pop. 149,900), is the second largest city in Bolivia. It lies in a small but thickly populated basin in the *Cordillera Real*, or *Royal Range*, of the Andes Mountains (see BOLIVIA [color map]). It is in the center of a rich agricultural area. It was founded in 1574. HAROLD OSBORNE

COCHIN CHINA. See VIETNAM (History).

COCHINEAL, *KAHCH uh NEEL*, is a natural dye obtained from the dried bodies of a tropical scale insect, the female *Dactylopius coccus*. Cochineal may be used to dye wool crimson, carmine, and scarlet. The insects are native to Mexico and Central America, but they have been taken to Spain, Algeria, and Java. The insects feed on cactus plants. The bodies of 70,000 insects yield only 1 pound (0.5 kilogram) of dye. Coal-tar dyes have largely replaced cochineal. See also CARMINE; DYES AND DYEING. FRED FORTESS

Brown Bros.

Cochise, Chief of the Chiricahua Apaches, led his people in war against the United States for nearly 11 years.

COCHISE, *koh CHEEZ* (? -1874), an American Indian leader, was a chief of the Chiricahua Apaches. He came to notice in 1861 when an army officer tried to capture him under a flag of truce for a crime he had not committed. Cochise escaped and then led his tribe in a war against the white settlers. He was daring and used brilliant strategy in battles against the army.

A white man named Jeffords made friends with Cochise in 1862. In 1871, Jeffords led General O. O. Howard to Cochise's hiding place for an interview. Cochise accepted a reservation for the Chiricahua Indians through Howard. He moved his tribe to the reservation and died there in 1874. His burial place was kept secret and has never been found.

Cochise helped hold back the tide of white settlement in the Southwest. There have been several fictional accounts of his life. They show him as a man who fought for a cause in which he believed, but who used savage methods of waging war. WILLIAM H. GILBERT

COCHLEA. See EAR (The Inner Ear; How We Hear; color diagram).

COCHRAN, JACQUELINE (1912-), is an American businesswoman and pioneer airplane pilot. She started flying in 1932, and was the only woman to enter the McRobertson London-Melbourne Race in 1934. Miss Cochran also became the first woman to compete in the Bendix Trophy Race, which she won in 1938. During World War II, she organized and commanded the Women's Airforce Service Pilots (WASPs). She received the Distinguished Service Medal, the first civilian woman to be so honored. Miss Cochran became the owner of a cosmetics firm in 1935. She was born in Pensacola, Fla. ROBERT B. HOTZ

Jacqueline Cochran

Wide World

COCHRANE, MICKEY (1903-1962), rose to baseball fame as a catcher for the Philadelphia Athletics and catcher-manager for the Detroit Tigers. He ranks with Bill Dickey of the New York Yankees as one of baseball's two finest catchers. He was a masterful handler of pitchers, and had a lifetime batting average of .320. He was struck on the head with a baseball in 1937. This speeded the end of his playing career. Cochrane was elected to the Baseball Hall of Fame in 1947. Gordon Stanley Cochrane was born in Bridgewater, Mass. He attended Boston University. ED FITZGERALD

COCK OF THE ROCK is a handsome South American bird with a rich orange plumage and a large crest that hides the bill. The wings and tail are black. The birds live in rocky ravines near mountain streams in the Andes from Colombia to Bolivia. They are also found in the mountains of the Guianas and in northern Brazil. At the mating season, the male birds gather together in a cleared spot in the forest where they dance and hop about to attract the females.

The cock of the rock makes its nest of plant fibers which it glues together with resin, and sticks to crevices of rocks. The birds feed on fruit and live in the thick undergrowth near the floor of the forest.

Scientific Classification. The cock of the rock belongs to the cotinga family, *Rupicolinae*. It is genus *Rupicola*, species *rupicola*. RODOLPHE MEYER DE SCHAUENSEE

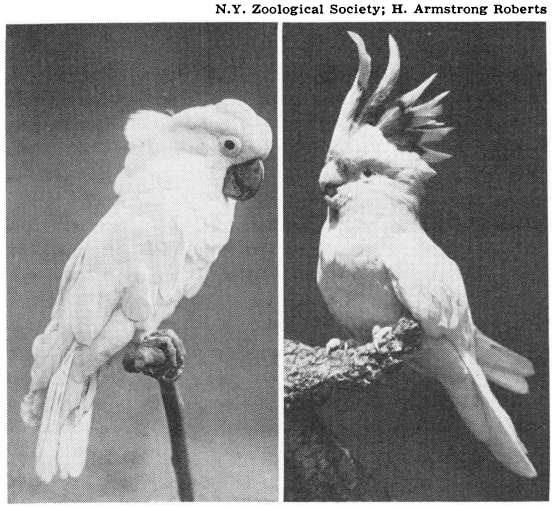
See also BIRD (color picture: Birds of Other Lands).

COCKATOO, *KAHK uh TOO*, is a perching bird that belongs to the parrot family. It lives in Australia, Indonesia, and neighboring islands. The cockatoo looks like a parrot, but has a crest which it can raise and lower. The cockatoo's coloring may be combinations of white, black, red, rose, or gray. The common white cockatoo has a yellow or rose crest. The cockatoo has a powerful, curved bill and a thick tongue. It has strong feet with which it climbs about the branches of trees.

The cockatoo feeds on seeds, nuts, and fruits. It is a great pest in regions where there are many orchards.

Two Kinds of Cockatoos. The specimen at the left has blue eyes which contrast vividly with its white feathers. The Leadbeater cockatoo at the right has a salmon-pink inner wing.

N.Y. Zoological Society; H. Armstrong Roberts



COCKCROFT, SIR JOHN

Cockatoos are often seen in large flocks which fly swiftly. Cockatoos become tame and make amusing pets. They are not popular, however, because they rarely learn to talk, and often scream loudly.

Scientific Classification. Cockatoos belong to the parrot family, *Psittacidae*. The great black cockatoo is genus *Probosciger*, species *P. aterrimus*. RODOLPHE MEYER DE SCHAUENSEE

See also BIRD (color picture: Family Pets); FLORIDA (Places to Visit [Parrot Jungle]); PARROT.

COCKCROFT, SIR JOHN DOUGLAS (1897-1967), a British nuclear physicist, won the 1951 Nobel prize in physics with Ernest T. S. Walton for being the first to split atoms artificially. Cockcroft and Walton bombarded lithium atoms with protons accelerated to high speeds. Each lithium atom became two helium atoms. In World War II, Cockcroft directed air-defenses research, and organized atomic-energy research in Canada. He became the head of Churchill College in Cambridge, England, in 1959. In 1961, he received the Atoms for Peace Award. Cockcroft was born in Walsden, Lancashire. See also PARTICLE ACCELERATOR; WALTON, ERNEST T. S. SIDNEY ROSEN

COCKER SPANIEL, sometimes called the *American cocker*, is one of the most popular dogs in the United States. Cockers are favorite pets and show dogs. They are named for their ability to hunt birds called woodcock. However, few cockers are now used as hunting dogs. Most cocker spaniels weigh 22 to 28 pounds (10 to 13 kilograms) and stand about 15 inches (38 centimeters) at the shoulder. Cockers have a soft, thick coat with *feathers* (long hairs) on the ears, chest, and legs. Many cockers have a solid colored coat. Pure black cockers are especially popular. Other solid colored cockers and mixed black and tan cockers are called *ascobs*. Cockers with red and white, black and white, or three-colored combination coats, are called *parti-colors*. See also DOG (picture: Sporting Dogs). MAXWELL RIDDLE

COCKFIGHTING is a sport in which two *gamecocks* (fighting roosters) battle each other in a fight to the death. The sport is illegal in the United States, Canada, and many other countries. But it is sometimes carried on secretly. Cockfighting ranks as a popular public sport in Spain, Latin America, and part of the Orient.

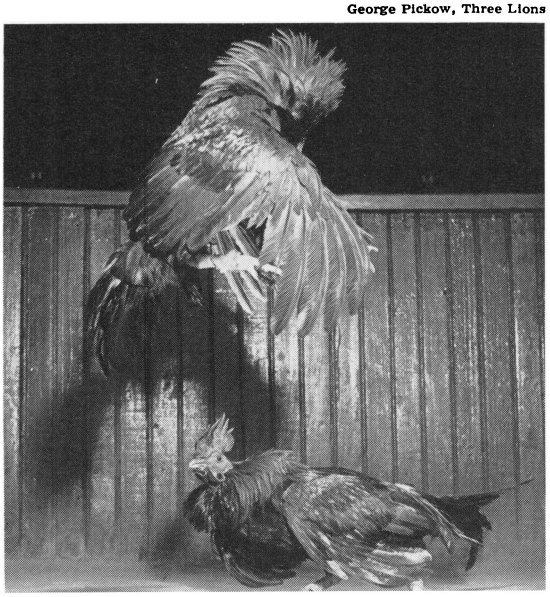
Gamecocks are specially bred to achieve physical power, speed of movement, courage, and the killer instinct. They usually are brightly colored and have long spurs on their legs. But breeders generally trim the spurs down, and attach artificial spurs to the gamecocks' legs. The spurs are usually steel or brass. The birds use the weapons to rip and tear at their opponents.

A cockfight takes place in an enclosed pit, usually outdoors. Spectators place bets on their favorite gamecocks. At the start of the fight, handlers hold their birds firmly and allow them to peck at each other. When the birds are angry, they are released and start to fight.

Cockfighting probably began in Asia thousands of years ago. The sport came to ancient Greece and Rome by way of India and China. It spread throughout Europe. During the 1700's, the sport became popular in England, where the training and breeding of fighting cocks became an important industry. WALTER HAROLD GREGG

Fierce Gamecocks Fight to the Death in the sport of cockfighting. Cockfighting is outlawed in many countries.

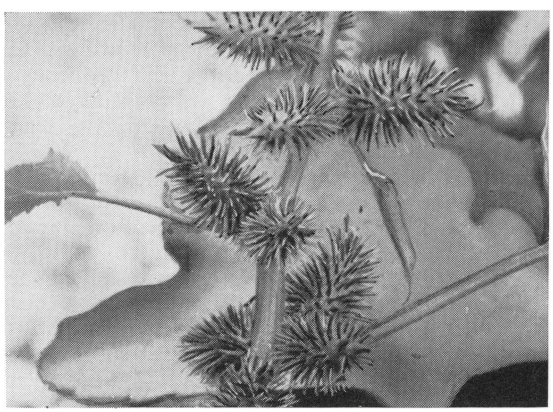
George Pickow, Three Lions



COCKLE, *KAHK'l*, is a sea animal with a tough, protective shell. The cockle is a kind of clam. It has a round, grooved shell divided into two equal parts. The cockle moves about by using a long, muscular organ called a *foot*. This foot is strong enough to flip the animal short distances. Cockles live in shallow water along ocean coastlines in many parts of the world. They may be from $\frac{1}{2}$ inch to 8 inches (1.3 to 20 centimeters) in diameter. The largest kinds of cockles are found on the Pacific coast of Central America.

Scientific Classification. Cockles are in the phylum *Mollusca* and the family *Cardiidae*. R. TUCKER ABBOTT

COCKLEBUR, or CLOTBUR, is the name of several kinds of annual weeds belonging to the composite family. They all have spiny burs, inside of which are the seeds. There are usually two seeds in each bur. One seed will begin to grow, or germinate, a season before the other seed. The burs are covered with hooked prickles which stick to clothing. The poisonous seedlings can kill hogs and young cattle. Cockleburs are native to the American continent. They are found in low areas in fields and by roadsides. They are 1 to 3 feet (30 to 91 centimeters) tall, and their rough leaves are heart-shaped or irregular. Some of the flowers bear pollen, while others bear seeds. The pollen-bearing ones grow on the upper branches and the seed-bearing ones on the



L. W. Brownell

The Cocklebur Has Burs That Stick to Animals.

lower. To get rid of cockleburs, the plants must be destroyed before the seeds ripen or be sprayed with 2,4-D.

Scientific Classification. Cockleburs belong to the composite family, *Compositae*. Cockleburs make up the genus *Xanthium*. LOUIS PYENSON

COCKNEY is a nickname for a citizen of London, particularly one from the East End area. According to the traditional definition, a cockney is anyone born within the sound of the bells of St. Mary-le-Bow Church. *Cockney* also applies to a dialect of English. Speakers change certain vowel sounds; for example, *lady* becomes *lydy* and *road*, *rowd*. They also drop the *h* at the beginning of words, and may add one in front of a word starting with a vowel; for example, *ard* for *hard* and *hanswered* for *answered*. The word *cockney* originally meant a misshapen egg.

See also LONDON (The People); BUTTON (picture).

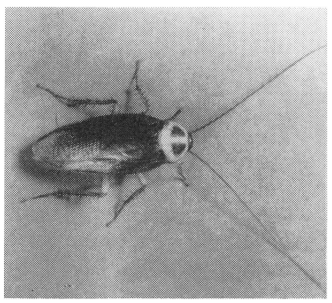
COCKPIT OF THE REVOLUTION. See NEW JERSEY.

COCKROACH is a troublesome, unpleasant insect found throughout the world. It is closely related to grasshoppers and crickets. There are over 2,000 species of cockroaches.

The cockroach has a flattened, slippery body, covered with a shiny, leathery casing. It has long legs covered with bristles. The strong legs permit the cockroach to run rapidly. The cockroach is one of the fastest runners among insects. The insect has long *antennae* (feelers).

Cockroaches eat food, garbage, bookbindings, and other insects, such as bedbugs. They live in bakeries, groceries, office buildings, restaurants, hotels, flour mills, libraries, and homes. Swarms of them slip out at night through cracks in the walls and floors to look for food. Cockroaches are dirty and spread germs on everything they touch. Many kinds of cockroaches are found outdoors. They often can be found under stones and leaves or the loose bark of rotting logs and dead trees.

The most common kinds of cockroaches found in houses in America are the *Croton bug* or *German cockroach*, the *American cockroach*, the *Australian cockroach*, the *brown-banded cockroach*, and the *Oriental cockroach* or *black beetle*. The Croton bug is smaller than the other kinds, but it is more destructive. It also reproduces more rapidly than the others. It gets its name because it first was found in large numbers in the Croton waterworks system of New York City. The Croton bug is a pale yellow-brown with two stripes on the front part of the body. The other kinds of cockroaches vary in color from light to dark wood-brown.



Lynwood M. Chace

Cockroaches dislike bright light, and usually come out only at night. These insects reproduce in dirty, damp places.

Cockroaches usually can be kept out of houses by keeping the rooms clean and dry. Cockroaches grow and reproduce best where there is dirt, grease, and moisture. They can be killed by using roach powders that contain sodium fluoride, borax, sodium fluosilicate, rotenone, or pyrethrum. Roach powder should be dusted around sinks and water pipes. The cockroach takes the poison into its body when it grooms itself. It scrapes the foreign particles and dust from its body with its legs and then draws its legs and feelers through its mouth.

Cockroaches can be trapped easily in large wide-mouthed jars. Food scraps should be placed in the jar and a paper funnel fitted into the top.

Scientific Classification. Cockroaches make up the cockroach family, *Blattidae*. The German cockroach is genus *Blattella*, species *B. germanica*. URL LANHAM

See also ORTHOPTERA.

COCKSCOMB, *KAHX KOHM*, is a flower with heads of red and yellow blossoms shaped like a rooster's comb or like an ostrich plume. The cockscomb comes from tropical America, Asia, and the East Indies, but it now grows in all parts of the United States. It will bloom from midsummer until the fall frost if planted in light, rich soil that is kept damp.

U.S. Bureau of Plant Industry

Cockscomb Blooms are shaped like a rooster's comb.

Scientific Classification. Cockscombs belong to the amaranth family, *Amaranthaceae*. They are genus *Celosia*, species *C. argentea*, variety *cristata*.

See also AMARANTH; FLOWER (color picture: Fall Garden Flowers).

COCKSPUR. See HAWTHORN; SANDBUR.

COCKTAIL. See ALCOHOLIC DRINK (Compounded Liquors).

COCOA, *KOH koh*, is a reddish-brown powder made by grinding the *nibs* (kernels) of the seeds of the cacao tree. The cocoa is melted and pressed to remove the fat. Then it is ground and sifted into a powder. *Chocolate* is the cocoa mass with the fat left in. See also CACAO; CHOCOLATE.

COCONUT PALM is the tall, graceful tree on which the coconut grows. It probably is native to southeast Asia and the islands of Melanesia in the Pacific Ocean. But man has introduced it to all the tropical and subtropical parts of the world. It stands from 40 to 100 feet (12 to 30 meters) high. Large featherlike leaves spread from the top of its branchless trunk.

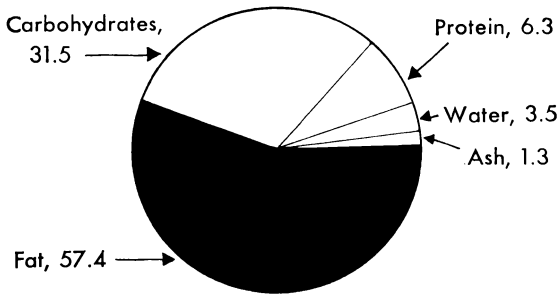
The coconut palm is one of the most useful trees. People in the tropics build houses and bridges from its wood. They use whole leaves to make thatch roofs, and strips of leaves to make hats, mats, and baskets. They make a sweet drink called *toddy* or *tuba* from the sap of the tree's blossoms. They also use this sap to make sugar, vinegar, and an alcoholic beverage.

The Coconut is the fruit of the coconut palm. Clusters of these large round fruits grow among the leaves of the tree. Each coconut has a smooth light-colored *rind*. Under the rind is a 1- to 2-inch (2.5- to 5-centimeter) *husk* of reddish-brown fibers. The husk and rind surround a brown woody shell that has three soft spots called *eyes* at one end. The rind and husk are usually cut away before the coconuts are marketed.

J. C. Allen and Son; New York Botanical Garden

Coconut Palms have smooth trunks with featherlike leaves at the top. The coconuts grow in clusters among the leaves.

Food Value of the Coconut



The Seed of the Coconut lies inside a hard brown shell, *right*. A thick husk, *far right*, grows around the shell.

The coconut seed lies inside the shell. It is a ball of crisp, white, sweet-tasting coconut *meat* covered by a tough brown skin. Its hollow center holds a sugary liquid called coconut *milk*. The coconut seed measures from 8 to 12 inches (20 to 30 centimeters) long and from 6 to 10 inches (15 to 25 centimeters) across.

A well-tended tree produces about a hundred coconuts a year. Each fruit takes about a year to ripen. Ripe coconuts fall from the tree. But on plantations, they are usually cut every two or three months.

Solid, dried coconut meat is called *copra*. Copra contains a valuable oil that is used for cooking and to make margarine and soap. Tropical lands produce millions of tons of copra each year. About 6,000 medium-sized coconuts make 1 short ton (0.9 metric ton). To make copra, coconuts are split open and dried in the sun or in ovens. Some coconuts are dried by smoking.

Throughout the world, people enjoy eating crisp, juicy chunks of fresh coconut meat. Shredded and dried coconut meat adds a distinctive flavor and texture to candy bars and other foods. People in tropical lands also use the coconut husk. They weave its short stiff fibers (called *coir*) into mats, ropes, and brooms.

Growing Coconut Palms. In the tropics, people can plant coconut palms throughout the year. They half bury the coconut in a horizontal position. Within six months, a single leaf sprouts from one of the eyes and pushes through the husk. The young palm can be transplanted after one to four years. It will bear fruit in seven or eight years. Coconut palms need much water and a temperature of at least 72° F. (22° C) most of the year.

Scientific Classification. The coconut palm belongs to the palm family, *Palmae*. It is genus *Cocos*, species *C. nucifera*.

HAROLD E. MOORE, JR.

See also COPRA; TREE (picture); PALM (Kinds of Palms; pictures: Coconut Palms); PHILIPPINES (picture); TRANSPORTATION (picture: A Raft of Coconuts).

COCOON, *kuh KOON*, is a protective covering that encloses the pupa of many insects. The mature larva prepares the cocoon as a shelter around itself. Inside the cocoon, the larva changes to a pupa and eventually transforms into an adult insect. Among the insects that spend part of their lives in cocoons are ants, wasps, bees, and moths. Spiders spin silk cocoons around their eggs to protect them.

The chief substance of most cocoons is silk. But often the larva produces other substances from which it builds a cocoon. It may also use hairs from its own body, wood pulp, earth, or grains of sand. Some creatures use little or no silk in constructing their cocoons.

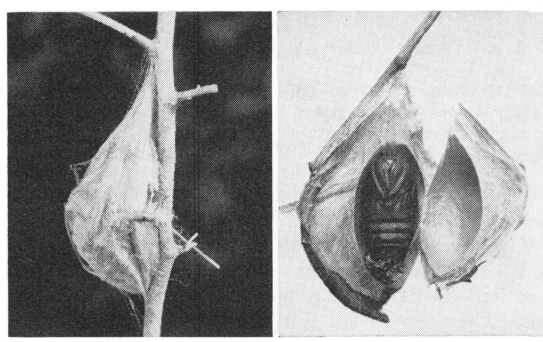
Most moth caterpillars (larvae) form cocoons. But many pass the pupal stage in the soil without a protective covering. A few butterfly caterpillars make flimsy

LEADING COCONUT-GROWING AREAS

Copra grown in 1971

Philippines	1,792,400 short tons (1,626,040 metric tons)
Indonesia	804,700 short tons (730,010 metric tons)
India	308,600 short tons (279,960 metric tons)
Sri Lanka	215,000 short tons (195,000 metric tons)
Malaysia	200,600 short tons (181,980 metric tons)

Source: *Production Yearbook, 1971*, FAO



Hugh Spencer

The Cocoon of the Cecropia Moth, *left*, has been built on a tree's limb. The opened cocoon, *right*, shows the pupa inside.

cocoons. Perhaps the best-known cocoon is that of the domestic silkworm, which supplies most commercial silk. Some tussah silk obtained in India comes from the cocoons of large emperor moths.

Most moth caterpillars build their cocoons in inconspicuous places. They may choose a place under loose boards, beneath the bark of a tree, or among dead leaves or trash. *Cecropia*, *Promethea*, and *Cynthia* moth larvae build large cocoons that they fasten to tree twigs. These can easily be found in the winter when the trees are bare. The pupae spend the winter inside the cocoon. But the larva of many other kinds of moths does not change into a pupa until spring. The *woolly bear caterpillar*, the larva of the tiger moth, builds its cocoon in spring. Still other kinds pass the winter in the egg stage or as partly grown larvae. ALEXANDER B. KLOTS

Related Articles in WORLD BOOK include:

Caterpillar	Metamorphosis	Silk (Raising Silkworms)
Chrysalis	Moth	
Larva	Pupa	

COCOS ISLANDS, or KEELING ISLANDS, are a coral group in the Indian Ocean. The Cocos Islands belong to Australia. They lie about 1,150 miles (1,851 kilometers) southwest of Singapore. The 27 islands have a total area of about 5 square miles (13 square kilometers) and a population of 618. The chief product is *copra* (dried coconut meat). The Cocos Islands were once governed as part of the British colony of Singapore. In 1955, Great Britain turned the islands over to Australia. JUSTUS M. VAN DER KROEF

COCTEAU, *kahk TOH*, **JEAN** (1889-1963), was a French avant-garde writer. As a playwright, author of ballet plots, screenwriter, novelist, and artist, he often used his talents to shock the public. But many of his shocking works also have great artistic merit.

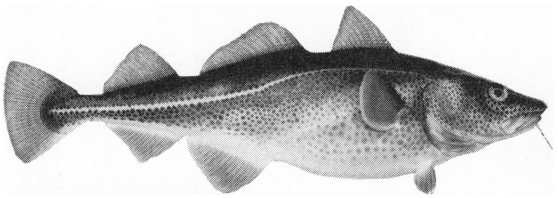
Cocteau, like many other French writers, was drawn to the myths and dramatic plots of ancient Greece. He frequently used these materials in his plays. *Orpheus* (1925) is a study of the poet's agonizing search for inspiration and his struggle to gain acceptance for his work. *The Infernal Machine* (1934) is an adaptation of Sophocles' *Oedipus Rex*. Its theme is that the powers guiding the universe are hostile to humanity. In Cocteau's usual fantastic style, these plays use events out of time sequence, unexpected colloquial phrases, and symbols explainable in terms of modern psychology.

Cocteau's novels include *Les Enfants Terribles* (1929). His ballets include *Parade* (1917) with music by Erik Satie. Cocteau wrote and directed several motion pictures, including *The Blood of a Poet* (1932), *Beauty and the Beast* (1945), and *Orpheus* (1950). *Professional Secrets*, a collection of his autobiographical writings, was published in 1970.

Cocteau was born in Maisons-Laffitte. His publicized love affairs and his use of drugs made his private life as unconventional as his writing. MALCOLM GOLDSTEIN

COD is one of the most important food fishes found in the sea. It lives along both shores of the North Atlantic Ocean, as far south as France and Virginia. The Alaskan cod of the North Pacific Ocean and Bering Sea is also important as food. Both are near relatives of the hake and haddock.

The cod has a slightly flattened body that tapers abruptly to the tail. It has five fins. It is usually greenish or olive on the back and sides, which are dotted with many small brown spots. The larger fish weigh from 20 to 35 pounds (9 to 16 kilograms). The smaller weigh about 12 pounds (5 kilograms). The largest cod ever caught off the New England coast by commercial fishermen was over 6 feet (2 meters) long and weighed 211½ pounds (96 kilograms).

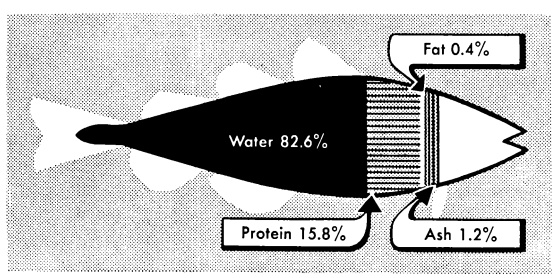


Codfish Rank Among the Most Important Food Fishes.

The cod eats lobsters, shrimps, crabs, and other crustaceans, as well as mollusks, small fishes, and seaweed. It is such a greedy eater that it will swallow almost anything that comes its way. Pieces of rubber and leather, scissors, oil cans, glass, stones, and garbage have been found in the stomachs of captured fish. Along the northern coast of Europe, the cod lays its eggs in February, March, and April. On the American coast it lays its eggs from October to June. Summer and winter are spent in deep water, spring and fall near the shore. These fish produce an astonishing number of eggs. It has been estimated that if all the eggs laid during the life of a 75-pound (34-kilogram) fish developed into adults, the ocean would be filled with an almost solid mass of cod. A 21-pound (10-kilogram) cod produces 2,700,000 eggs in one spawning period.

The eggs are small, averaging $\frac{1}{19}$ inch (1.3 millimeters) in diameter. They float in the upper layer of surface water, forming part of the plankton (see PLANKTON). Fishes, crustaceans, and other animals eat the eggs, thus cutting down the reproduction rate.

Cod Fishing. The chief cod fisheries of the world are those of Norway and Sweden, Great Britain, France, Canada, Iceland, and the United States. About 28,000 short tons (25,000 metric tons) of codfish are caught annually by fishermen from the United States. American fishermen usually go to the Grand Banks of Newfoundland (ridges in the ocean where the water varies in depth from 50 to 1,000 feet [15 to 305 meters]), and to the George's Bank, off Cape Cod. Nearly all the ships of the United States Atlantic codfishing fleet hail from Gloucester, Mass.



The Food Elements Found in Fresh Codfish

British Trawlers' Federation

Fishermen Catch Codfish in a large net called a *trawl*. The fish are then dumped into compartments on the ship's deck.

Fishermen usually fish for cod two or three weeks at a time. They usually use diesel-powered ships that can locate schools of cod by radar. A large bag-shaped net called a *trawl* is lowered into the water and dragged at a depth of about 2,100 feet (640 meters) for two or three hours. The fish swim into the mouth of the trawl. A successful catch may weigh 1 short ton (0.9 metric ton). The trawl is hauled up by winches and the fish are released into compartments on the deck. Later, the fishermen clean the fish and store them in ice.

Marketing and Uses. Most codfish caught by U.S. fishermen is made into fillets or steaks. Some cod is also used in making frozen fish sticks or cakes. Canada, Iceland, Norway, and Spain rank as the leading exporters of salted and dried cod.

Cod-liver oil, obtained from the liver of the fish, is rich in vitamins needed by children. But man-made products have largely replaced cod livers for oil.

The importance of the cod in the early history of the United States is shown in the fact that it had a place on the seal of Massachusetts Colony, and today a gilded codfish hangs in the Massachusetts House of Representatives. The abundance of the fish along the eastern shores of America was noted by early voyagers.

Scientific Classification. Codfish belong to the codfish and hake family, *Gadidae*. The Atlantic codfish is genus *Gadus*, species *G. morhua*. LEONARD P. SCHULTZ

See also COD-LIVER OIL; FISH (picture: Fish of Coastal Waters and the Open Ocean); POLLACK; SCROD.

COD-LIVER OIL is a thin, pale-yellow oil made from the fresh livers of codfish. It has a slightly fishy odor and taste. Cod-liver oil contains large amounts of vitamins A and D, and is easily digested by the body. It prevents such nutritional diseases as rickets. Persons who get poor food and little sunshine have the greatest need for cod-liver oil.

Cod-liver oil was once an important food for infants and young children, and it is still used today. But it has largely been replaced by man-made substances containing comparable amounts of vitamins A and D.

Cod-liver oil is used in treating some forms of tuberculosis. The oil may also have some value in healing injured tissues, and it can be applied directly to the skin. AUSTIN SMITH

See also COD; RICKETS; VITAMIN.

CODA. See MUSIC (Terms).

CODDINGTON, WILLIAM. See RHODE ISLAND (History).

CODE, in law, combines all the laws on a given subject in a single statute or ordinance. It is passed by a legislative body, such as a state legislature, a county board of supervisors, or a village board. It is purely *statutory law*, as distinguished from the *common law* that arises from court decisions. In theory, it is possible for all the laws in a code to be new. That is, no law has ever been passed dealing with the particular subject. But in practice, a code nearly always represents a systematic and comprehensive revision of all the laws that the legislative body has passed on a given subject.

Statutes usually develop only as problems arise that point out the need for rules and regulations on particular points. Laws concerning automobiles are an example. The first rules set speed limits and required drivers to keep to the right. Then vehicles, and later drivers, were licensed. Stop signs, traffic lights, and other traffic regulations were established. Many cities passed their own regulations without regard to making them consistent with the state laws. Such piecemeal legislation left many gaps, uncertainties, and conflicts among the many separate regulations. As a result, most states revised their motor-vehicle laws, made them consistent, filled the gaps, and removed uncertainties. They enacted a single series of laws called a *Motor Vehicle Code*. Other well-known codes include state commercial codes and local or county building codes. Some villages combine all their laws into a *village code*. EDWARD W. CLEARY

CODE CIVIL. See CODE NAPOLÉON.

CODE NAPOLÉON is the name often given to the code that contains the civil, as distinguished from the criminal, law of France. In 1800, Napoleon Bonaparte appointed a commission of jurists to combine all French civil laws into one code. The code went into effect in 1804. That same year, after Napoleon became emperor of France, the code became known as the *Code Napoléon*. But its official name is *Code Civil*.

The Code Napoléon represented a compromise between the customary law of northern France and the Roman law of the south. It also compromised between the ideas of the French Revolution and older ideas. It gave new liberty to the people, but kept such ideas as the system of inheritance. The Code Napoléon influenced law in Europe, South America, the state of Louisiana, and the province of Quebec. But its influence has declined. Even in France, it has been changed by new laws and court decisions. EDWARD W. CLEARY

CODE OF HAMMURABI. See HAMMURABI.

CODE OF JUSTINIAN. See JUSTINIAN CODE.

CODEINE, *KO deen* (chemical formula, $C_{18}H_{21}NO_3 \cdot H_2O$), is a drug which is made from opium. Codeine has the same properties as morphine, but is weaker. It relieves pain and produces sleep. It is used to treat severe coughs and asthma, intestinal pains, and neuralgia. See also MORPHINE; OPIUM. A. K. REYNOLDS

CODES AND CIPHERS are methods of writing a message so that only persons with a key can read it. There are many methods of putting a message in secret form. The plain text can be *encoded* or *enciphered* to produce a *cryptogram*. The cryptogram or secret text can later be *decoded* or *deciphered*. Putting messages into code or cipher is called *cryptography*, a word that comes from Greek words for *hidden* and *writing*. *Cryptanalysis* is the art of breaking or solving codes and ciphers without the key. Cryptography and cryptanalysis make up *cryptology*.

Common Cryptographic Systems

Cipher Systems involve either transposition or substitution, or a combination of the two. In *transposition systems*, the cryptographer rearranges the elements of his plain text—usually single letters. For example, the message LEON ARRIVES WEDNESDAY might be enciphered as ANOEL EVIRR NDEWS YADSE. In this case, the system divides the original message into 5-letter groups, then reverses the order of the letters in each group. In *substitution systems*, the elements of the plain text—single letters or pairs of letters—retain their original positions, but are replaced by other elements. For example, LEON ARRIVES WEDNESDAY might be enciphered as EMHG YKKSTMN UMAGMNAYW. But cryptograms rarely keep their original word divisions. Instead, the cipher text is usually sent in 5-letter groups, in this case EMHGY KKSTM NUMAG MNAYW. Extra letters, called *nulls*, fill out the final 5-letter group if needed.

Code Systems are a specialized form of substitution in which the cryptographer treats syllables, words, phrases, and even whole sentences. Code systems employ *code books* that contain the code groups for a large number of words and phrases in a specialized vocabulary, such as that used in military operations. Each plaintext meaning has its own code group, usually composed of four or five letters or digits. For example, the code group BANAT might mean the word "attack," and the code group BANEV might mean the phrase "attack progressing satisfactorily." Code books also include *syllabary groups*, so cryptographers can encode proper names or other words that do not appear in the book itself. *California* might be encoded with the code groups for CAL, I, FOR, NI, and A.

Transposition Ciphers involve the use of a geometric design, such as a square or rectangle. The cryptographer inscribes the plaintext letters by one route in the design, then transcribes them by another route to form the cipher text. In *columnar transposition*, the cryptographer chooses a numerical key and writes his plaintext letters under it. He then takes the columns of letters in key-number order to form the cipher text. In the following example, the cryptographer uses the *key word* BREAKFAST, and gives each letter in it a number as it would appear in the alphabet. The first A is numbered 1, the second A is numbered 2, the B is numbered 3, and so on. The cryptographer then writes his plain text in rows under the numbers of the key. Suppose he wishes to report HEAVY ARTILLERY BARRAGE CAUSING SEVERE CASUALTIES AMONG OUR TROOPS. First he writes the key word, BREAKFAST, then the key numbers, and finally the text. When he takes the columns off in numerical order, he has his cipher text. To decipher the message, a cryptographer would simply reverse the process. The final cipher text would begin VRCVL GSRAS EERHL, and so on.

B	R	E	A	K	F	A	S	T
3	7	4	1	6	5	2	8	9
H	E	A	V	Y	A	R	T	I
L	L	E	R	Y	B	A	R	R
A	G	E	C	A	U	S	I	N
G	S	E	V	E	R	E	C	A
S	U	A	L	T	I	E	S	A
M	O	N	G	O	U	R	T	R
O	O	P	S					

Monoalphabetic Substitution Systems employ a single cipher alphabet, consisting of two parts, a *plain component* and a *cipher component*. In this example, the letters of a key word, MONARCHY, are placed first to produce a mixed sequence for the cipher:

Plain: ABCDEFGHIJKLMNOPQRSTUVWXYZ
Cipher: MONARCHYBDEFGIJKLPQSTUVWXZ

To encipher the word AMMUNITION, the cryptographer would locate the cipher letters below the plain letters, MGGTIBSBJI.

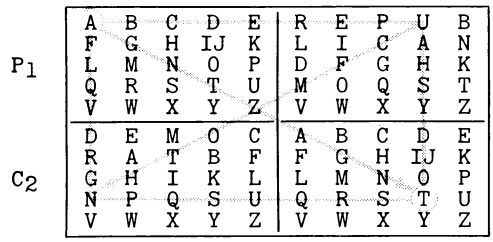
Biliteral substitution uses a matrix such as this:

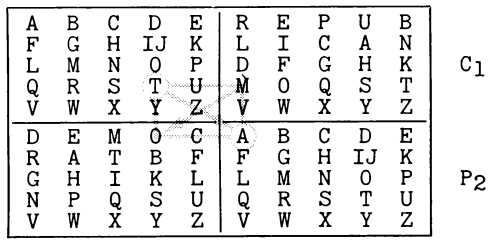
	A	E	I	O	U
B	A	B	C	D	E
C	F	G	H	IJ	K
D	L	M	N	O	P
F	Q	R	S	T	U
G	V	W	X	Y	Z

Here the plaintext letters have two-letter cipher equivalents. For example, ENEMY would be enciphered as BU DI BU DE GO. The cryptographer could use digits for the row and column designators, so that ENEMY might come out 10 38 10 37 59.

Polyalphabetic Substitution Systems employ more than one alphabet during encipherment. In the Vigenère table (named for Blaise de Vigenère, a French cryptographer of the 1500's who first described it in print), the plaintext letters appear in the row of letters

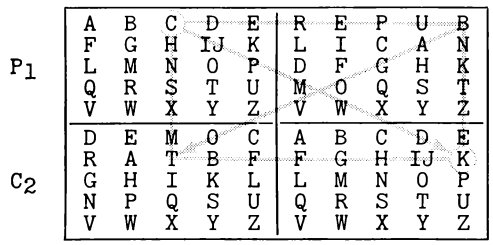
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
B	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A
C	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B
D	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C
E	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D
F	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E
G	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F
H	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G
I	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H
J	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I
K	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J
L	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K
M	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L
N	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M
O	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N
P	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Q	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
R	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
S	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
T	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
U	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
V	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
W	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
X	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Y	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
Z	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y

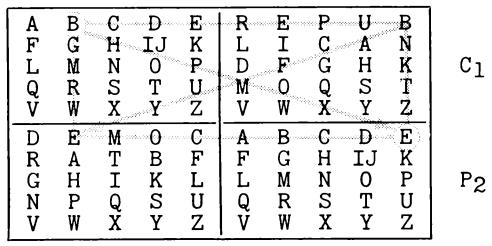




Digraphic Substitution looks more complicated than it actually is. The cryptographer treats digraphs, or pairs of the letters of his plain text, as the elements for encipherment. He locates the first two letters in the plain sections of a four-square matrix (marked P_1 and P_2) and then finds the cipher text in the cipher sections at the opposite corners of an imaginary rectangle. The matrix *above left* is marked for the first two letters, and the one *above right* for the second two letters. The matrix *below left* shows the third pair, and the one *below right* the fourth pair. In this case, the plain and cipher letters are the same for the fourth pair. Using this matrix, the final message would be enciphered as follows:

Plain: AT TA CK BE GI NS AT DA WN
Cipher: UN MO BT BE AA GQ UN RO XH



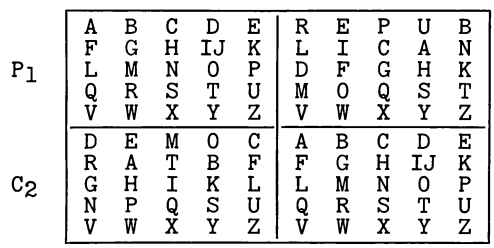


at the top of the table, the key letters at the side, and the cipher letters within the square.

The cryptographer writes a key word over and over above his plain text. Then he looks down the column under his plaintext letter to find its cipher equivalent in the row that begins with his key letter. For example, if the key word is BLUE and the message is NINE PRISONERS TAKEN, the cryptographer would write these three lines:

```
K:  BLUEB  LUEBL  UEBLU  EBL
P:  NINEP  RISON  ERSTA  KEN
C:  OTHIQ  CCWPY  YVTEU  OFY
```

In *digraphic substitution* the cryptographer treats pairs of letters, rather than single letters, as the elements of his plain text. In the *four-square matrix* shown here, he finds the first two letters of his message in squares P_1 and P_2. He uses these two points to form a rectangle, and finds the first two letters of cipher text in squares C_1 and C_2. He repeats the process for the other digraphs of his message, as shown in the illustration at the top of this page.



The German Army once used a *combined substitution-transposition cipher*, the so-called *ADFGVX system*. German cryptographers began by substituting letters in a 6x6 biliteral matrix containing the 26 letters and the 10 digits. They then inscribed the cipher text from this step into a transposition rectangle and took the columns of the rectangle in key order for the final cipher. In this example, the message ATTACK BEGINS AT DAWN is first enciphered as DGVXV XDGDX . . . , and this is written in

	A	D	F	G	V	X
A	B	2	E	5	R	L
D	I	9	N	A	1	C
F	3	D	4	F	6	G
G	7	H	8	J	Ø	K
V	M	0	P	Q	S	T
X	U	V	W	X	Y	Z

G	E	R	M	A	N	Y
3	2	6	4	1	5	7
D	G	V	X	V	X	D
G	D	X	G	X	A	A
A	F	F	X	D	A	D
F	V	V	D	G	V	X
F	D	D	G	X	F	D
F						

the rows of the transposition rectangle. The final cipher text will begin VXDGX GDFVD . . .

Some cryptographic systems employ *syllabary squares* or *code charts*, and may be considered primitive code systems. With this example of a syllabary square, a message could be encrypted as it would be in using the syllabary groups of a code book.

	1	2	3	4	5	6	7	8	9	Ø
1	A	1	AL	AN	AND	AR	ARE	AS	AT	ATE
2	ATI	B	2	BE	C	3	CA	CE	CO	COM
3	D	4	DA	DE	E	5	EA	ED	EN	ENT
4	ER	ERE	ERS	ES	EST	F	6	G	7	H
5	8	HAS	HE	I	9	IN	ING	ION	IS	IT
6	IVE	J	Ø	K	L	LA	LE	M	ME	N
7	ND	NE	NT	0	OF	ON	OR	OU	P	Q
8	R	RA	RE	RED	RES	RI	RO	S	SE	SH
9	ST	STO	T	TE	TED	TER	TH	THE	THI	THR
Ø	TI	TO	U	V	VE	W	WE	X	Y	Z

This square is only 10 x 10. If the square were increased to such dimensions as 26 x 26, with letters to mark the rows and columns, instead of the 10 digits, the square could contain common words and perhaps

even short phrases. The square would then be classed as a *code chart*.

Mechanical Devices

Cipher Devices mechanically encipher or decipher messages, usually on the principles of polyalphabetic substitution. Some simply consist of two rotating concentric discs, each bearing a sequence of 26 letters. The cryptographer uses one disc to locate the plaintext letters, and the other for their ciphertext equivalents. Such a *cipher disc*, with normal alphabetic sequences, would be the equivalent of the Vigenère table. The cryptographer would set the particular key letter in the cipher component against "A" in the plain component. In order to provide successive shifts in the alphabets, as the code word BLUE did in the Vigenère table, the cryptographer might use a repeating numerical pattern such as 3-1-2-5-7-2-1, 3-1-2-5-7-2-1. Or he might begin at a prearranged initial setting and shift the discs by one position after enciphering or deciphering each letter. This *progressive alphabet system* would bring all of the alphabets into play in succession.

Sir Charles Wheatstone, a British scientist, invented a cipher device in 1867. It had two concentric discs and a gearing mechanism that automatically shifted the alphabets in an extremely irregular manner. The machine is known as the *Wheatstone cipher device*, but credit for the original invention belongs to an American, Decius Wadsworth. He built an identical device in 1817.

A French cryptologist, Étienne Bazeries, invented another type of cipher device in 1891. His *cylindrical cipher device* consists of 20 numbered discs on a central shaft, each bearing a different arrangement of the letters of the alphabet. To encipher a message, the cryptographer sets up the discs in a prearranged order. He arranges one row on the discs to form the first 20 letters of his message, then takes off any other row as the cipher text. He repeats the procedure for the rest of his message. To decipher the message, the cryptographer sets up the cipher message and examines the other rows for the one row that contains plain text all the way across. Bazeries was the first to describe this device in print. But credit for the original invention must again go to an American, Thomas Jefferson. In his papers, now in the Library of Congress, he described an almost identical device.

Cipher Machines are extremely complicated. They usually have a typewriter keyboard, and often need electric power. Some machines produce a printed tape with the enciphered or deciphered letters. Others, like teletypewriters, automatically encipher, transmit, and decipher at opposite ends of a circuit.

Concealment Systems

Concealment is not really a code or a cipher. It is a method of hiding a secret text in an otherwise innocent message or disguise. For example, the first letters of the words HAVE EXCELLENT LAUNCHING PLAN give the secret text HELP. In *open code systems*, the sender gives plaintext word equivalents to his secret text, then inserts them in an otherwise innocent message. In AUNT MARY LEFT FOR DETROIT ON FRIDAY, the words AUNT MARY might stand for "five troop ships," DETROIT might mean "Southampton," and FRIDAY might be "Monday."

Francis Bacon devised a famous concealment system. Combinations of two elements, called *a* and *b*, represent the letters of the alphabet. These two elements may be two different styles of type in a book, the arrangement of red and black cards in a deck of playing cards, or the location of light and dark chocolates in a box. For example, a writer might put a dot or

A:	aaaaa	G:	aabba	N:	abbaa	T:	baaba
B:	aaaab	H:	aabbb	O:	abbab	U–V:	baabb
C:	aaaba	I–J:	abaaa	P:	abbba	W:	babaa
D:	aaabb	K:	abaab	Q:	abbbb	X:	babab
E:	aabaa	L:	ababa	R:	baaaa	Y:	babba
F:	aabab	M:	ababb	S:	baaab	Z:	babbb

underscore under some of the letters in the innocent sentence ALL IS WELL WITH ME TODAY in order to convey the message HELP.

All	is	well	w	ith	me	today
aab	*bb*	*aaba*	*a*	*aba*	*ba*	*abbba*
H		E		L		P

The *b* letters are exaggerated with underscores here.

Cryptanalysis

The art of cryptanalysis requires extensive study and experience, unusual perseverance, considerable imagination—and just plain luck. It may be impossible to solve a single short cryptogram, even if the system is fairly simple. But, if a cryptanalyst has enough time, enough messages, and enough information about the correspondents and the nature of their messages, he might be able to solve even a complex system.

Each language has its own individual characteristics and peculiarities. Cryptanalysts work with extensive tables of statistics of single letters, two- and three-letter combinations (called *digraphs* and *trigraphs*), and other elements of the language. They know, for example, that E, T, A, O, N, R, I, and S are the most frequent ones in English. They also use lists of frequent words and phrases and of *pattern words* that contain repeated letters, such as ATTACK and VESSEL, of the *abba* class, and DIVISION and ELEMENT, of the *abaca* class.

History

Cryptography goes back to the time of the ancient Greeks. The Spartans wound a belt in a spiral around a *scytale* (stick), wrote a message along the length of the stick, and unwound the belt. This in effect was the first transposition cipher. No one could read the message unless he had a stick exactly the right size. Julius Caesar used a simple substitution cipher. Each letter of the plain text was replaced by the letter three positions to the right in the normal alphabet. By his system, we would encipher CAB as FDE.

Gabriel de Lavinde wrote the first manual on cryptography in 1379. Sicco Simonetta wrote the first treatise on cryptanalysis in 1474.

In the 1600's, Cardinal Richelieu invented a *grille*. He would place a card with holes in it over a sheet of paper, write his secret message in the holes, then fill in the rest of the paper to look like an innocent letter. Only a man with an identical grille could read the secret message.

LAMBROS DEMETRIOS CALLIMAHOS

See also NATIONAL SECURITY AGENCY.

CODEX. See BOOK (Early Forms of Books); MANUSCRIPT (Illustrated Manuscripts).

CODFISH. See COD.

CODICIL, *KAHD uh sil,* is an addition to a will. It may be written on the same piece of paper as the will or it may be a separate document. A codicil is regarded as part of the original will and revokes any part of the will which is not consistent with the codicil. It is believed that codicils were first made legal by the Emperor Augustus in ancient Rome. WILLIAM TUCKER DEAN

See also WILL.

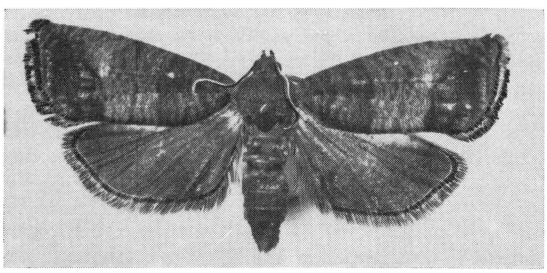
CODLING MOTH is a small brown and bronze-colored moth. The caterpillars of this moth cause severe damage to apples. They also destroy such fruits as pears, quinces, and English walnuts. Originally a native of Europe, the moth now lives in all parts of the world.

In spring, the adult moths emerge from their cocoons under loose bark and trash. They lay their eggs on leaves and twigs. The *larvae* (caterpillars) bore into young apples. This usually causes the fruit to die and drop off. A second generation of larvae may bore into the sides of larger apples. In some areas, there is even a third generation.

The chief method of controlling codling moths is by a series of four to seven sprayings. The spray may contain lead arsenate, lime sulfur, fixed nicotine, or various other poisons. The exact schedule for spraying varies with the location. Orchards and packing sheds should be kept clean of all loose bark, fallen apples, and trash.

Scientific Classification. The codling moth belongs to the leaf roller family, *Tortricidae.* It is genus *Carpocapsa,* species *C. pomonella.* ALEXANDER B. KLOTS

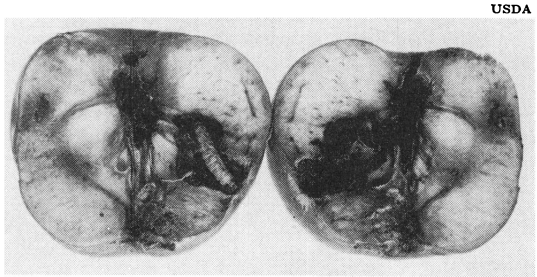
See also MOTH (color pictures).



U.S. Agricultural Service

The Codling Moth, *above,* **is less than 1 inch (2.5 centimeters) from wingtip to wingtip. It lays its eggs on apple trees. The larvae burrow into developing apples and eat the flesh,** *below.* **The larvae cause millions of dollars of damage every year.**

USDA



CODY, JOHN PATRICK CARDINAL (1907-), archbishop of Chicago, was appointed a cardinal of the Roman Catholic Church in 1967 by Pope Paul VI. Cardinal Cody won recognition as a church administrator while archbishop of New Orleans and Chicago.

Cardinal Cody was born in St. Louis. He was ordained a priest in Rome in 1931 where he received doctorates in philosophy and theology at the North American College. He served for five years on the staff of the Vatican secretary of state in the 1930's. He was appointed archbishop of New Orleans in 1964 and archbishop of Chicago in 1965. THOMAS P. NEILL

CODY, WILLIAM FREDERICK. See BUFFALO BILL.

COE COLLEGE. See UNIVERSITIES AND COLLEGES (table).

COEDUCATION means teaching both boys and girls, or men and women, in the same classrooms. Most public schools in the United States are coeducational. But many church-controlled and other private schools admit only males or females. Coeducation is still rare in many countries, especially in secondary schools.

Before the mid-1800's, many persons opposed education for girls. Educators barred girls from some U.S. public schools. Sometimes girls could attend classes only during the lunch hour or after school hours, when boys were not present. But women's struggle for equal rights helped open schools and colleges to them.

Oberlin College in Oberlin, Ohio, became the first United States coeducational college. In 1835, it announced, "Young ladies attend recitations with young gentlemen in all the departments." Oberlin graduated three women with the bachelor of arts degree in 1841.

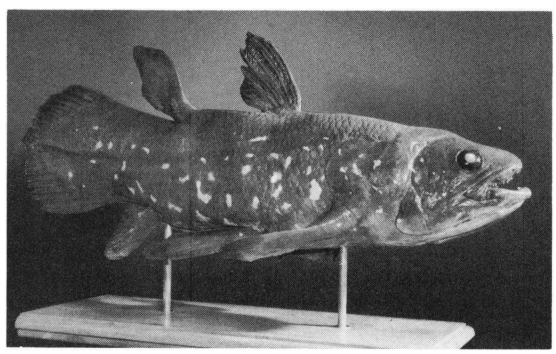
The state universities helped the cause of coeducation in the United States. It developed rapidly in the late 1800's. For instance, the University of Michigan opened its departments to women in 1870. Today, women may enter graduate and professional schools that were formerly open only to men. R. FREEMAN BUTTS

COEFFICIENT. See ALGEBRA (Other Definitions).

COEFFICIENT OF FRICTION. See FRICTION.

COEFFICIENT OF LINEAR EXPANSION. See HEAT (Changes in Size).

COELACANTH, *SEE luh kanth,* is a fish belonging to the group of *lobe-finned* fishes. Scientists believe that four-legged land animals developed from the lobe-finned fish hundreds of millions of years ago. They thought all lobe-finned fish had been extinct for many millions of



Wide World

Coelacanths Grow Over 5 Feet (1.5 Meters) Long.

years. But in 1938, a living coelacanth was caught off South Africa. Others have been found near Madagascar. The coelacanth is a large, blue, oily fish.

Scientific Classification. The coelacanth belongs to the subclass *Crossopterygii*. They make up the coelacanth family, *Coelacanthidae*. CARL L. HUBBS

See also EVOLUTION; PREHISTORIC ANIMAL (Animals with Backbones; Living Fossils).

COELENTERATE, *sih LEHN tuh rayt*, is one of a group of soft-bodied animals. The group includes the freshwater hydras, hydroids, jellyfish, sea anemones, and corals. These animals make up the *phylum* (large group) called *Coelenterata*. There are about 9,000 species of coelenterates, and most of them live in the sea.

The word *coelenterate* comes from Greek words that mean *hollow intestine*. Many of these animals have a large digestive cavity. The coelenterate body may be shaped like a cylinder, a bell, or an umbrella. Every coelenterate has at least two layers of cells that form its body wall. An outer layer makes up the body covering, and an inner layer lines the digestive cavity. Many coelenterates have a third, or middle, layer of cells.

A *medusa*, or jellyfish, is a coelenterate that has a bell- or umbrella-shaped body. Its mouth is at the underside of the body. Tentacles with special stinging cells hang downward from the body's ringlike edge. Medusas swim about freely in the sea.

A *polyp* is a coelenterate that has a body shaped like a hollow cylinder. A polyp lives with one end of its body attached to the sea bottom. The mouth and tentacles are on the other end. Polyps may exist singly or may live together in colonies. For example, hydras and sea anemones are single polyps, and hydroids and most corals are colony-forming polyps.

Some coelenterates have both medusa and polyp stages in their lives. Buds on a polyp first develop into medusas. The medusas eventually break free and swim away. Then the medusas produce eggs and sperm that unite and develop into polyps. ROBERT D. BARNES

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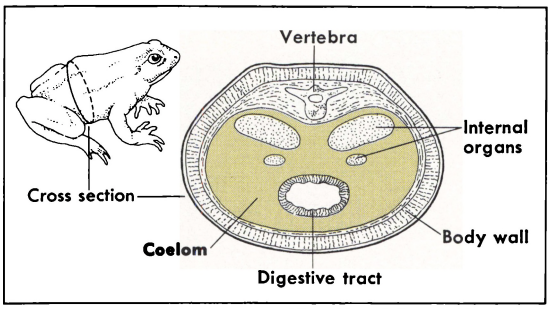
Coral	Jellyfish	Sea Anemone
Hydra	Portuguese Man-of-War	Sea Fan

COELODONT. See PREHISTORIC ANIMAL (The Age of Mammals).

COELOM, *SEE luhm*, is the body cavity found in vertebrates and higher invertebrates. The soft internal organs, such as the liver and the stomach, are suspended in the coelom.

The coelom is an important characteristic in separating the lower animal phyla from the higher phyla. The space provided by the coelom has enabled the higher animals to develop complex internal organ systems. Organs within the coelom are bathed by *coelomic fluid*. This fluid lubricates the organs and enables them to twist and slide against one another without harm.

Animals that have a coelom are called *eucoelomates*. They have a body plan that can be described as a "tube within a tube." The digestive tract forms the inner tube, and the body wall forms the outer tube. The coelom is the space between the tubes. This arrangement results from developments that occur during the animal's growth as an embryo. In its early stages, the embryo consists of a hollow sphere of cells called the *blastula*. The cavity within the blastula is called the *blastocoele*. Eventually, the cells located at one point on the blastula



WORLD BOOK diagram by Marion Pahl

The Coelom is the body cavity between the digestive tract and the body wall. All vertebrates and higher invertebrates have a coelom, in which many organs are located.

begin to *invaginate*—that is, they start to fold inward into the blastocoele. This tubelike invagination forms a primitive gut, lined by a layer of cells called *endoderm*. The cells on the outer wall of the blastula make up a layer called the *ectoderm*. A third layer of cells, the *mesoderm*, develops between the ectoderm and endoderm. The mesoderm completely fills what remained of the blastocoele. The coelom, a totally new cavity, develops within the mesoderm and, therefore, is lined entirely by mesodermal cells.

Certain lower invertebrates have a tube-within-a-tube body plan but lack a true coelom. These *pseudocoelomates*, including roundworms and rotifers, have a body cavity that serves some of the functions of a true coelom. In pseudocoelomate embryos, the mesodermal cells do not completely fill in the blastocoele. The blastocoele is retained and becomes the body cavity in the adult animal. Unlike a true coelom, this pseudocoelom is not lined completely by mesoderm.

Invertebrates called *acoelomates*, which are lower than pseudocoelomates, have a solid mesodermal layer with no body cavity. Flatworms and ribbon worms are acoelomates. WILLIAM C. BURNS

COENZYME. See ENZYME.

COERCIVE ACTS. See INTOLERABLE ACTS.

COEUR D'ALENE, *kur duh LAYN*, Ida. (pop. 16,228), lies on Lake Coeur d'Alene in northern Idaho (see IDAHO [map]). The main industries in the city and the scenic lake region include tourism and the manufacture of lumber. The Coeur d'Alene area is a hunting and fishing center. Farming, dairying, and mining are other major occupations in the surrounding region. Coeur d'Alene serves as the seat of Kootenai County, and has a mayor-council form of government. WILLIAM S. GREEVER and JANET GROFF GREEVER

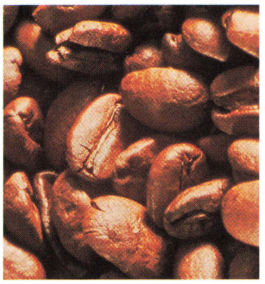
COEUR D'ALENE MOUNTAINS, sometimes called the BITTERROOT MOUNTAINS, form the northern part of the Bitterroot Range of the Rocky Mountains. They extend for about 40 miles (64 kilometers) along the Idaho-Montana border (see IDAHO [physical map]).

The Coeur d'Alene Mountains look like a rolling upland cut by many streams, and have few prominent peaks. Ridge elevations vary from 5,200 to 6,800 feet (1,580 to 2,070 meters) above sea level. HARRY H. CALDWELL

COEXISTENCE, in international relations. See COMMUNISM (Communism Today); COLD WAR.

Gene Harris, Meyers Photo-Art

Giuseppe Mazza



Dave Cormier, DPI

Coffee comes from berries, *above left,* that grow on trees. During a coffee harvest, workers pick the berries by hand, *left.* Each berry contains two beans. Roasted beans, *above right,* are ground up and brewed with hot water to make the beverage.

COFFEE, the drink made from the roasted and ground beans of the coffee tree, is the favorite hot drink in almost every country in temperate or cold climates.

The United States ranks as the largest consumer of coffee. Americans drink about 415 million cups every day. The rich aroma of coffee adds much to the pleasure of drinking it. The *coffee break* has become an integral part of the business world. Each morning and afternoon, millions of workers pause for a few minutes of relaxation over a cup of coffee. The average American drinks the brew from about 14 pounds (6 kilograms) of coffee annually. Each year, the United States uses about 2,775,000,000 pounds (1,258,700,000 kilograms) or about one-third of all the coffee grown in the world. Other leading coffee-consuming countries include France, Italy, The Netherlands, and West Germany. Brazil grows more than 3 billion pounds (1.4 billion kilograms) of coffee—about 30 per cent of the world's coffee crop. Coffee is vital to the economies of many Latin-American countries.

Coffee contains caffeine, a drug that acts as a stimulant to mental and physical energy. The drink tends to expand blood vessels mildly so that more blood flows to the heart and brain. See CAFFEINE.

From Bean to Cup

The Coffee Plant. The scientific name of the common coffee tree is *Coffea arabica.* It originally grew wild in Ethiopia. It is now cultivated in Java, Sumatra, India, Arabia, equatorial Africa, Hawaii, Mexico, Central and South America, and the West Indies.

Coffea arabica is a shrub with glossy, evergreen leaves. It reaches a height of 14 to 20 feet (4.3 to 6.1 meters) when fully grown. As a rule, coffee growers prune it to under 12 feet (3.7 meters). The flowers of the *Coffea arabica* are white.

The coffee berry begins to grow while the tree is blossoming, and ripens from green to yellow to red. The average tree bears enough berries each year to make about 1½ pounds (0.7 kilogram) of roasted coffee.

A coffee tree is usually 5 years old before it bears a full crop. The common variety grows best at altitudes of from 2,000 to 6,000 feet (610 to 1,800 meters) in a tropical climate. Most trees grow from seeds that are first planted in nursery beds. After a year, the seedlings are transplanted to prepared fields.

Preparation for Market. All berries must be hand-picked, because no one has yet found a way to harvest them successfully by machine. After the berries are picked, they are put through a *sluice* (bath of running water). Sticks, leaves, and the green and bad berries float on top. The good ones sink to the bottom.

Pulping. The good berries then go to a pulping house, where machinery removes the pulp. Each berry contains two *beans* (seeds). Each bean has a thin parchmentlike skin, and a second covering called the *silver skin.* At first, the uncovered beans are soft and bluish-green, but later they become hard and pale yellow.

After the pulping process, the beans are run through a series of fermenting and washing tanks. The beans are then dried and left to cure for several weeks.

LEADING COFFEE-GROWING COUNTRIES

Coffee production in 1972

Brazil	3,122,000,000 lbs. (1,416,100,000 kg)
Colombia	992,000,000 lbs. (450,000,000 kg)
Ivory Coast	582,000,000 lbs. (264,000,000 kg)
Angola	450,000,000 lbs. (204,100,000 kg)
Mexico	437,000,000 lbs. (198,200,000 kg)
Uganda	397,000,000 lbs. (180,100,000 kg)
El Salvador	331,000,000 lbs. (150,100,000 kg)
Indonesia	298,000,000 lbs. (135,200,000 kg)
Ethiopia	284,000,000 lbs. (128,800,000 kg)
Guatemala	262,000,000 lbs. (118,800,000 kg)

Source: *Foreign Agriculture Circular: Coffee,* July, 1972, U.S. Department of Agriculture

Hulling and Peeling make up the next step. Milling machines remove the parchment and the silver skin. As the beans come from the machine, a fan blows off the loose skins. The beans then go to a machine called the *separator*, which removes sand, dust, and small or broken beans. The beans are sorted until only the largest and best of the coffee beans remain.

Roasting. Most coffee is shipped in 132-pound (60-kilogram) burlap bags. At the roasting plant, the beans are emptied into chutes leading from an upper to a lower floor. An air-suction device removes dust and other materials. The coffee then goes to the blending machine, a cylinder that mixes different types of coffee.

From the blender, the beans flow by gravity to storage bins, then to roaster ovens. There, they are roasted at 900° F. (482° C) for 16 to 17 minutes. The beans lose about a sixth of their weight during roasting. The beans are then cooled and cleaned, and carried to bins where they are stored until ground. After being ground to *drip*, *regular*, or *fine* requirements, the coffee is packed either in vacuum tins or in paper bags.

Instant Coffee can be either *powdered* or *freeze-dried*. Both require adding water to make coffee.

Powdered instant coffee is made by brewing coffee in huge containers and evaporating the water from the brew. The remaining powder crystals become coffee again when water is added.

Freeze-dried instant coffee is made by converting freshly brewed coffee into an extract and freezing it in slabs. The slabs are ground into chunks and placed in pressurized chambers. Moisture in the form of ice is drawn off, leaving dry coffee crystals.

A Good Cup of Coffee. Best brewing results are obtained by using one standard coffee measure, or two level tablespoons of coffee, to each cup. The water should be freshly drawn from the cold-water tap. Most coffee is made in *percolators*, *drip* pots, or *vacuum* coffeemakers, which strain boiling water through the coffee.

Kinds of Coffee

More than a hundred kinds of coffee are sold in the United States. They may be divided into three general groups—*Brazils*, *Milds*, and *Robustas*. The Milds include all *Coffea arabica* grown outside of Brazil. *Coffee Robusta* is a different kind of coffee, most of which grows in Africa. Most coffee is named for the region where it grows or the port from which it is shipped. *Mocha* is named for the port of Mocha (Al Mukhā) in Yemen (Ṣan'ā'). *Java* grows in and near Java.

American roasters place great importance on the taste of their blends. They pack different blends for different parts of the country. Coffee prepared for the South often has chicory added to it.

Some persons find it more healthful to drink *decaffeinated coffee*. The removal of caffeine is a cold-water extraction, done with the aid of certain chemicals.

History

According to legend, coffee was discovered in Ethiopia when goatherds noticed that their flocks stayed awake all night after feeding on coffee leaves and berries. Coffee reached Arabia in the 1200's. *Coffee* comes from the Arabic word *qahwah*. Before its use as a beverage 700 years ago, coffee was a food, then a wine, and then a medicine. Coffee moved from Arabia to Turkey during the 1500's, and to Italy in the early 1600's. Coffeehouses sprang up throughout Europe in the 1600's and people met there for serious discussions. Coffee probably came to America in the 1660's. Coffee-growing was introduced in Brazil in the 1700's.

Coffee-exporting countries have tried for many years to control coffee prices and surpluses. At first, they agreed to export quotas that limited each country's exports. They also tried to control prices by stockpiling some coffee instead of exporting it. But in 1963, the United Nations helped arrange an International Coffee Agreement that included both exporting and importing countries. Exporting countries accepted export quotas. Importing countries agreed to observe a floor on prices and to limit their coffee purchases from countries that did not sign the agreement.

Scientific Classification. Coffee belongs to the madder family, *Rubiaceae*. The common coffee tree is genus *Coffea*, species *C. arabica*.

JOHN F. MCKIERNAN

See also BRAZIL (pictures); CHICORY; COSTA RICA (pictures); EL SALVADOR (picture); SOUTH AMERICA (picture: Growing Coffee).

Gene Harris, Meyers Photo-Art

Gene Harris, Meyers Photo-Art

Loren McIntyre, Woodfin Camp, Inc.

Preparing Coffee for Market starts when workers sort the berries, *left*, and use a pulping machine to remove the coffee beans. The beans are dried in the sun, *center*, and are cured for several weeks. Then they are roasted, *right*, to bring out their flavor.

COFFEE HOUSE was a type of cafe that served as a center of business, cultural, and political life in London. Coffee houses thrived from about 1650 to 1850.

Many Londoners went to one or more coffee houses several times daily to learn the latest news. As newspapers developed, reporters also obtained information there. Many men kept regular hours at coffee houses, so that friends and clients knew when and where to find them. Eventually, each house developed a group of customers who had similar business, cultural, political, or religious interests. Large trading companies had their headquarters at certain coffee houses. Actors, painters, writers, and politicians gathered at others.

In 1730, London had about 500 coffee houses. During the 1800's, they were gradually displaced by the home delivery of mail, the growth of daily newspapers, and the appearance of private clubs. THOMAS A. ERHARD

COFFER. See ARCHITECTURE (Architectural Terms).

COFFERDAM is a temporary enclosure built in water. When the water is shallow, the cofferdam may be an earth dike. For greater heights, it is commonly made of two rows of piles, tied together. The space between them is packed with soil or rock. When the cofferdam is finished, the water is pumped out, leaving a dry foundation. Piers or other structures can then be built there. Cofferdams have been used to examine and repair sunken ships. ROBERT G. HENNES

See also CAISSON; PILE.

COFFIN. See FUNERAL CUSTOMS (Burial); SARCOPHAGUS.

COFFIN, ROBERT PETER TRISTRAM (1892-1955), was an American poet, essayist, novelist, and biographer. His book of verse, *Strange Holiness*, won the 1936 Pulitzer prize in poetry. As a professor and teacher, he had a great influence on other writers.

Over 40 of his books were published. They include *The Dukes of Buckingham* (1931), *Yoke of Thunder* (1932), *Red Sky in the Morning* (1935), *Saltwater Farm* (1937), *Primer for America* (1943), *Yankee Coast* (1947), and *Apples by Ocean* (1950). *Lost Paradise* (1934) is his autobiography. Coffin was born in Brunswick, Me. He graduated from Bowdoin College. EDWIN H. CADY

COG. See SHIP (The Cog).

COGNAC. See ALCOHOLIC DRINK (Distilled Liquors).

COGNATE. See ETYMOLOGY; LINGUISTICS.

COGWHEEL. See WHEEL AND AXLE (Uses).

COHAN, *koh HAN*, GEORGE M. (1878-1942), was a great American actor, theatrical director, songwriter, and playwright. Before he was 40, he was a leading producer and had created a popular form of musical play. Cohan starred in many of his own productions.

He began his stage career in his childhood. While only in his 20's, he won wide recognition for his acting, songs, and plays as a member of the Four Cohans, a family group. He wrote such popular songs as "Give My Regards to Broadway," "Over There," and "You're a Grand Old Flag." Cohan's plays include *Little Johnny Jones; Forty-Five Minutes from Broadway; George Washington, Jr.; The Song and Dance Man;* and adaptations of *The Miracle Man* and *Seven Keys to Baldpate.*

Cohan was also successful as the father in Eugene O'Neill's play, *Ah, Wilderness!* and as Franklin D. Roosevelt in the musical, *I'd Rather Be Right.* The motion picture, *Yankee Doodle Dandy*, told the story of Cohan's life. George Michael Cohan was born on July 3, 1878, in Providence, R.I. But he considered July 4 as his birthday. BARNARD HEWITT

COHEN, LEONARD (1934-), is a Canadian poet and novelist. He has also won international fame as a songwriter and folk singer, setting his own poems to music.

Cohen's poetry is romantic, but he often mixes romance with cynicism and irony. His poems cover a variety of topics, including religion, love, and politics. Many of his lyrics and poems are imaginary scenes that refer to religious or sexual symbols. He also describes the people and places of Montreal. A number of his writings blend historical and current events into timeless, dreamlike occurrences. *Selected Poems 1956-1968* (1968) is a good introduction to Cohen's poetry. His novels include *The Favorite Game* (1963) and *Beautiful Losers* (1966).

Leonard Norman Cohen was born in Montreal. He graduated from McGill University there in 1955 with a degree in English and later studied law at Columbia University in New York City. CLAUDE T. BISSELL

COHESION, *koh HEE zhuhn*, is the force that holds a material together. Cohesion results from the attraction that all atoms and molecules have for one another. This attraction decreases greatly as the distance between the molecules of a substance increases. Thus, with few exceptions, cohesion is highest in solids. Liquids have somewhat less cohesion than do solids, and gases have much less.

Because of cohesion, effort is required to separate a material in two. This effort is called the *work of cohesion.* The work required to separate the material is twice its surface tension because two new surfaces have been created (see SURFACE TENSION).

Scientists can calculate the *tensile* (breaking) strength of materials if they know the work of cohesion. These calculated strengths are very high. Actually, however, many materials can be broken relatively easily. Scientists believe this is so because of small surface cracks and other imperfections in solid materials. Glass fibers, for example, have great resistance to breakage when first manufactured, but they develop fine cracks and lose strength rapidly. High tensile strengths cannot be easily measured in liquids because the molecules flow when force is applied. E. D. GODDARD

See also ADHESION; MOLECULE (Molecules and Matter).

COHN, FERDINAND JULIUS (1828-1898), was a German botanist and pioneer in bacteriology. He became the first to show that bacteria are plants. In 1872, he published the first systematic classification of bacteria into genera based upon morphology. With his help, Louis Pasteur disproved the theory of spontaneous generation (see SPONTANEOUS GENERATION). Cohn also contributed to the understanding of heat production by plants. He was born in Breslau, Germany (now Wrocław, Poland). STANLEY E. WEDBERG

COHO. See SALMON (Kinds of Salmon).

COHORT. See LEGION; PRAETORIAN GUARD.

COHOSH. See SNAKEROOT.

COIFFURE. See HAIRDRESSING (Styling).

COIL. See IGNITION; INDUCTION COIL.

WORLD BOOK photo

Many Coin Collectors mount their coins in albums. The girl shown above is using a magnifying glass to examine the details of a coin. She holds the coin by the edges to avoid staining it. Her coin catalog, rear, provides information about various coins.

COIN COLLECTING is one of the most popular hobbies in the world. Most coin collectors simply enjoy trying to acquire a complete set of a nation's coins or of one or more particular coins. Some people collect coins as works of art. Others collect them as an investment, to be sold later at a profit. Through coins, a collector can also learn something about certain famous people and events in a country's history.

Imaginative coin collectors can build many types of collections. For example, they can specialize in coins of one country or in various kinds of coins, such as cents or dollars. They can collect coins of unusual sizes or shapes. Many collectors concentrate on coins that illustrate a certain subject, such as animals, ships, or famous women.

The collecting or study of coins is called *numismatics*, and a coin collector is often called a *numismatist*. These words come from the Greek word *nomisma* and the Latin word *numisma*, both of which mean *a piece of money* or *a coin*. Numismatics includes paper money and also medals, tokens, and similar objects. This article tells how to begin and care for a coin collection.

Starting a Coin Collection. The best source of coins for a beginning collector is the change he receives when making various purchases. He also can ask friends to let him check the coins they may have—and swap his money for any he does not have in his collection. Many beginning collectors go to a bank and exchange their money for rolls of coins. They then examine the rolls to find coins for their collection.

A coin's value depends on two factors—its condition and how easily it can be obtained. The most valuable coins are both *uncirculated* (unused) and scarce. A beginning collector should seek easily obtainable coins at first.

As a collector learns more and more about the hobby, he can start to acquire coins of greater value from several sources. For example, coin dealers and many collectors sell, trade, and buy coins. Some collectors obtain coins through auctions held in various communities or by mail. The person who offers the highest bid for a coin is entitled to buy it. In many countries, a government agency sells uncirculated coins to collectors.

A person should have some basic information about coin collecting before starting to acquire coins. Several books for beginners can be obtained at bookstores, hobby shops, and libraries. They include *The Complete Book of Coin Collecting* (4th ed., 1973) by Joseph Coffin.

Many collectors subscribe to a specialized newspaper, such as *Coin World* or *Numismatic News*, both of which are published weekly. The American Numismatic Association, the largest organization of coin collectors, publishes *Young Numismatist*, a quarterly newspaper for young collectors. The association's monthly magazine, *The Numismatist*, carries the names of coin clubs in the United States and Canada. These clubs encourage new collectors to attend their meetings and exhibitions.

Collecting United States Coins. Any person who collects United States coins should have *A Guide Book of United States Coins*, edited by R. S. Yeoman. This book, called the Red Book because of its red cover, ranks as the standard reference work on U.S. coins. The Red Book gives the approximate price a person can expect to pay for any U.S. coin, depending on its condition and scarcity. A new edition is published annually.

The law requires United States coins to be dated with the year in which they are *struck* (made). The Department of the Treasury operates mints in Philadelphia, Denver, and San Francisco. The San Francisco mint strikes some coins for general circulation and also makes special sets of coins for collectors. Coins struck in the Denver or San Francisco mint have a *mint mark*.

THE CONDITION OF COINS

The condition of a coin plays an important part in determining its value. This table lists the terms used to describe a coin's condition, based on the amount of wear it has received.

Proof (Pf.) coins have a mirrorlike surface. They are struck especially for collectors.

Uncirculated (Unc.) coins are struck for general use but have never been in general circulation.

Extremely Fine (Ex. Fine) coins have been in circulation but show only slight wear.

Very Fine (V. Fine) coins show some wear on the highest points of the design but still have some of the original shine.

Fine (F.) coins show little wear but have no shine.

Very Good (V.G.) coins have some wear, but all the features of the design remain clear.

Good (G.) coins are worn, but the entire design can be seen plainly.

Fair coins show much wear but still have enough of the design to be identified.

Edward C. Rochette, the contributor of this article, is Executive Director of the American Numismatic Association.

SOME RARE AND INTERESTING COINS

Coin collectors prize coins that are rare or have some interesting feature. The Brasher's Doubloon is one of the rarest early American coins. The American commemorative half dollar honors the Negro educator Booker T. Washington. The Roman coin portrays the famous emperor Nero.

Coins of the United States

The American Numismatic Society
Brasher's Doubloon
(1787)

New York State Cent
(1787)

Indian Head Cent
(1882)

Booker T. Washington
Commemorative Half Dollar (1946)

Coins of Other Countries

Macedonian Tetradrachm
(336 to 323 B.C.)

Roman Coin
(A.D. 54 to 68)

Judean Shekel
(A.D. 66 to 70)

The American Numismatic Society
Persian Dinar
(A.D. 303 to 309)

French Denier
(800 to 814)

Indian Anna
(1910)

Canadian Dollar
(1935)

Vatican 500-Lire Coin
(1959)

All photos from Chase Manhattan Bank Money Museum unless otherwise indicated.

A small S is stamped on coins struck in San Francisco, and a small D appears on coins struck in Denver. Coins without a mint mark come from Philadelphia.

Until 1965, dimes, quarters, and half dollars contained 90 per cent silver. Most collectors tried to assemble a complete set of these coins—as well as cents and nickels—by date and mint mark. In 1965, the government replaced silver dimes and quarters with coins made of nickel and copper. In 1971, the government made a similar change in the metal composition of half dollars. During the late 1960's, the price of silver rose rapidly. As a result, the value of the silver in a coin rose above the coin's face value. Millions of silver dimes, quarters, and half dollars were melted for their silver. Almost no silver coins remain in circulation today.

Every year, the Bureau of the Mint strikes a limited number of cents, nickels, dimes, quarters, half dollars, and dollars for collectors. Many people buy a number of sets of these special *proof* coins as an investment. Information on proof sets and other numismatic items may be obtained from the Office of Public Services,

Bureau of the Mint, 15th Street and Pennsylvania Avenue NW, Washington, D.C. 20220.

Collecting Coins of Other Countries offers an almost endless variety of opportunities. For example, some collectors try to acquire one coin from every country in the world. Others build a collection of one-cent pieces from every country that issues them.

Two reference books, *Current Coins of the World* and *Modern World Coins* provide information about coins from other lands. Both are edited by R. S. Yeoman. Several other books deal with coins of specific countries and regions, such as Canada, England, and Latin America.

Many nations sell their coins in uncirculated condition to collectors. But some countries have tried to take advantage of the interest in coin collecting. They issue coins with designs featuring a subject that has nothing to do with the country. For example, some nations have struck coins bearing the portrait of Pope John XXIII or of a U.S. astronaut. These coins are made only for collectors. They are not made for general circulation in the country that issues them. Most collectors avoid such coins.

Many collectors specialize in coins from ancient Greece, Rome, or Palestine. Various ancient coins, especially those of Greece, are prized for their beauty and craftsmanship. Some collectors specialize in coins issued in Europe during the Middle Ages.

Caring for a Coin Collection. Coins should be protected from dust, fingerprints, and moisture, and from objects that could scratch them. A coin should be touched as little as possible. If one must be handled, it should be held by the edges and never put on the palm of the hand. Moisture from a person's skin can stain a coin.

Many stores sell albums in which to keep coins. Some collectors put their coins in metal cabinets that have trays lined with soft cloth. Others use small envelopes designed to hold coins.

Collectors should avoid cleaning their coins. Rubbing a coin to remove dirt or stains may increase the amount of wear on the metal and thus reduce the coin's value. A coin also may be scratched accidentally while being cleaned.

EDWARD C. ROCHETTE

For more information about coins, see the WORLD BOOK article on MONEY with its list of *Related Articles*.

COIN MACHINE is a device that works when a coin is dropped into a special slot. The coin sets the mechanism in motion. There are many different types of coin machines. *Vending machines* sell merchandise such as candy, coffee, peanuts, cigarettes, and gum. *Automats* are sometimes installed in restaurants to sell food. *Juke boxes* are coin machines that play music on phonograph records. A *penny arcade* consists of a number of machines, such as *pinball machines*, that are gathered in one place and used for amusement.

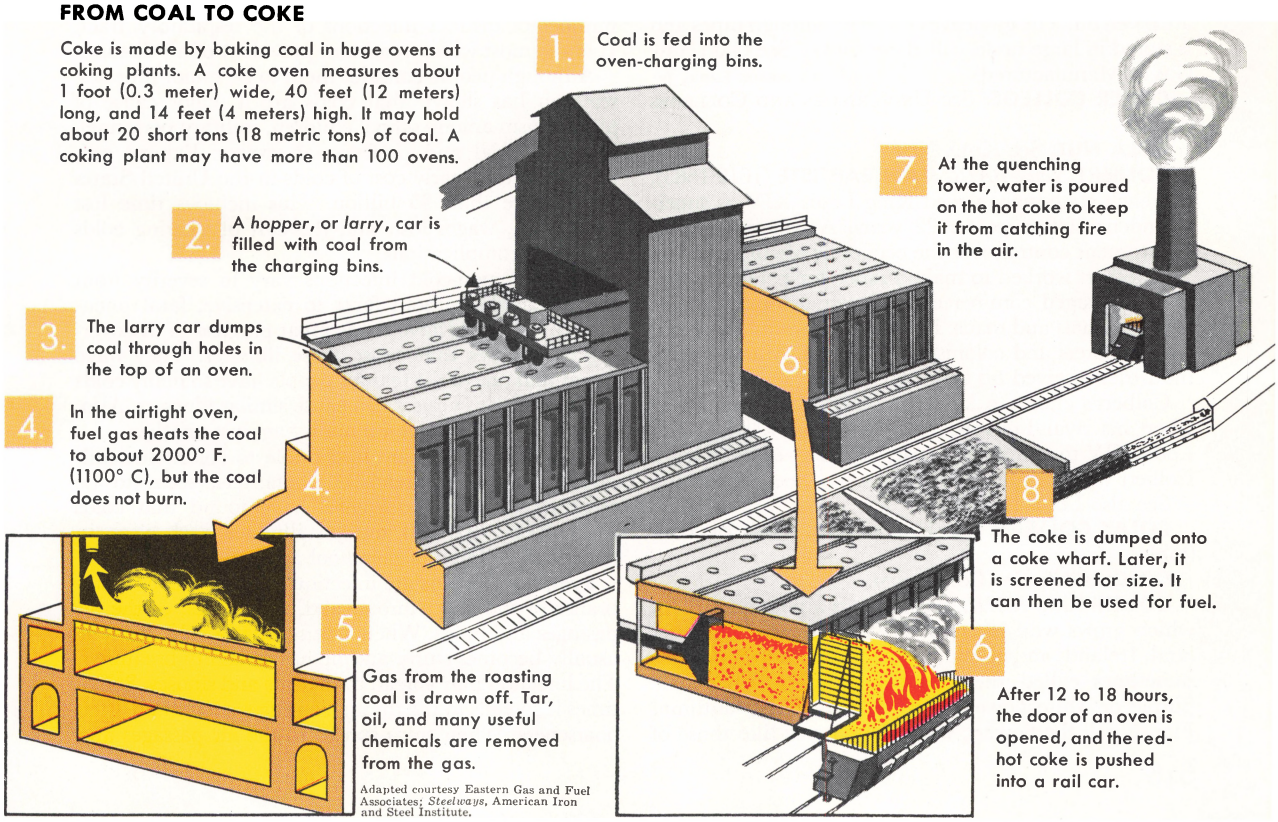
See also VENDING MACHINE; SLOT MACHINE.

COIR. See COCONUT PALM.

COKE is a hard, grayish substance obtained when soft coal is heated in an airtight coke oven. It contains 87 to 89 per cent carbon, and is hard and *porous* (full of tiny holes). Coke produces intense, smokeless heat when it burns.

Coke is made by heating *pulverized coal* (coal ground to a powder) in an airtight oven. As the coal heats, it *decomposes* (decays). It cannot burn completely with-

FROM COAL TO COKE



Adapted courtesy Eastern Gas and Fuel Associates; *Steelways*, American Iron and Steel Institute.

out air. Coal tar and coke oven gas evaporate from the decomposed coal and are drawn out of the oven. The escaping tar and gas form the pores in the coke. The hot coke is then taken out of the oven and cooled with water at a *quenching tower* to keep it from burning in the air.

Coke is valuable in *smelting* (melting) iron ore. Coke used in smelting is called *metallurgical coke*. In the United States, about 90 per cent of metallurgical coke is made in giant coking plants with ovens equipped to save valuable coal tar and coke oven gas. Some metallurgical coke is made in older ovens called *beehive ovens* because of their shape. These ovens do not save the coal tar and coke oven gas. CLARENCE KARR, JR.

See also COAL; GAS (How Gas Is Manufactured); IRON and STEEL (The "Recipe"); PETROLEUM COKE.

COKE, *kuk*, **SIR EDWARD** (1552-1634), was a brilliant English courtroom lawyer. He rose to prominence as speaker of Parliament in 1593. In 1594, he was selected over Sir Francis Bacon as Queen Elizabeth's attorney general, and in 1606 he became chief justice under King James I. As chief justice, Coke insisted that even the king was subject to the law. His famous *Institutes* and *Reports* (1600-1615) include many principles of modern law. Coke was born in Mileham, England, on Feb. 1, 1552. DANIEL J. DYKSTRA

COKE OVEN GAS, or COAL GAS, is the gas obtained when coal is heated in an airtight place. It consists mainly of hydrogen and methane. Coke oven gas is burned to produce heat in industrial plants and in homes. It was formerly used for illumination.

Coke oven gas is made by heating coal in a *by-product coke oven* that heats to about 2000° F. (1100° C). As the coal heats, coke oven gas and other by-products are given off. The gas leaves the oven through pipes and is stored in large tanks called *gas holders*. See GAS (How Gas Is Manufactured). CLARENCE KARR, JR.

COKER COLLEGE. See UNIVERSITIES AND COLLEGES (table).

COLA NUT. See KOLA NUT.

COLBERT, *kawl BAIR*, **JEAN BAPTISTE** (1619-1683), a French statesman, served King Louis XIV as superintendent of finance for 22 years. A believer in firm government control over the economic life of the country, Colbert worked to make France financially strong. He encouraged commerce and internal improvements such as canals and roads. He built a powerful navy and sent explorers and colonists to America. Many French industries received his support.

Colbert's efforts to keep the budget balanced failed when his rival Louvois, the war minister, persuaded Louis XIV to embark upon an expensive series of wars. Colbert was born in Reims. RICHARD M. BRACE

See also LOUIS (XIV).

COLBY COLLEGE. See UNIVERSITIES AND COLLEGES (table).

COLCHICINE. See COLCHICUM.

COLCHICUM, *KAHL chuh kuhm*, is a poisonous plant which grows wild in the moist meadowlands of England, Ireland, and of middle and southern Europe. It is sometimes called the meadow saffron. It has pale purple or white flowers which bloom in the autumn. Florists call the flowers, which look much like those of the crocus, *autumn crocus*. Colchicum is easily grown when planted in light, moist, sandy loam.

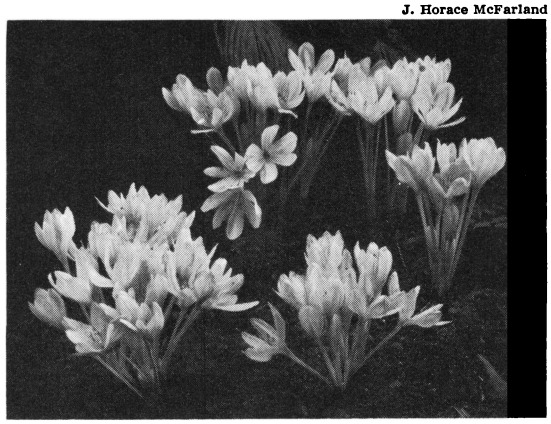
Colchicine, a bitter drug taken from the colchicum plant, is used in small quantities to treat gout and rheumatism. Botanists also use the drug in experiments in heredity. Colchicine has the effect of doubling the number of chromosomes in a cell. This doubling causes the plant offspring to become much larger than their parents.

Scientific Classification. The colchicum plant belongs to the lily family, *Liliaceae*. It is genus *Colchicum*, species *C. autumnale*. HAROLD NORMAN MOLDENKE

See also CROCUS.

The Pale Purple or White Flowers of Colchicum bloom in autumn. They look much like spring crocus blossoms.

J. Horace McFarland



COLD. See CLIMATE; HEAT.

COLD, COMMON. The common cold is any one of a number of distinct infections of the respiratory tract. It is the most widespread and prevalent of all diseases.

Although people consider them to be minor illnesses, research has shown that colds are a major cause of absenteeism among school children, military personnel, and industrial and professional groups. Experts estimate that the yearly cost of colds in the United States totals more than $5 billion. This includes time lost from work, wages lost, and the cost of treating colds and their complications.

The common-cold infections vary in severity from the mild cold without fever to extensive, fatal pneumonia. Scientists have made great progress in discovering the viruses that cause these illnesses. They have found that one of the reasons people have so many colds is that different viruses can cause similar illnesses. Also, one cold does not give immunity against another.

People of all ages are susceptible to colds. But children, particularly preschool youngsters, seem to be most susceptible. Researchers have found that colds cause more than 30 million illnesses each year in American children of preschool age.

Symptoms. Colds are infections of the mucous membranes of the nose, throat, and, sometimes, of the air passages and lungs. When a person has a cold, his nose usually becomes stuffy and he has difficulty breathing. The infection may spread to the ears and sinuses. Sometimes it spreads to the throat, causing soreness and often hoarseness. When colds spread to the air passages and

lungs, they may cause bronchitis and pneumonia. Head colds are sometimes called *coryza*.

The simplest kind of cold usually lasts only one or two days. More severe colds may last longer, often causing fever and aches and pains throughout the body. Occasionally, the patient also has chills and loses his appetite. Colds are dangerous because they make people more susceptible to other infections.

Treatment. There is no specific treatment for colds. But a doctor often prescribes drugs to relieve the discomfort caused by cold symptoms. For example, he may give aspirin or other pain-relieving drugs to lessen muscular aches and pains. Rarely, he may prescribe nasal sprays, which shrink the mucous membranes and allow the patient to breathe easier. Antihistamine drugs have been used to treat certain types of colds, but these should be taken only if prescribed by a physician. A patient who has a fever should stay in bed. This provides rest and isolates the patient from other persons.

Persons with colds should eat soft, nourishing foods. They should drink plenty of fluids such as fruit juices, tea, or plain water. If the cold persists or seems to get worse, a physician should be called. If complications begin to develop, the doctor will then be able to treat them early. Often he prescribes sulfa drugs and antibiotics to control complications.

Spread. Experts do not know all the ways in which cold germs spread. But doctors believe that a person can get a cold by breathing in the germs. Whenever a person with a cold coughs or sneezes, tiny droplets of moisture that contain cold germs spray out into the air. Anyone who breathes the air can "catch" the cold. For this reason, colds seem to spread most rapidly in places where many persons gather together, such as in schools, offices, theaters, or buses. A person should always cover his mouth and nose when he coughs or sneezes. Then the germs cannot spray out into the air.

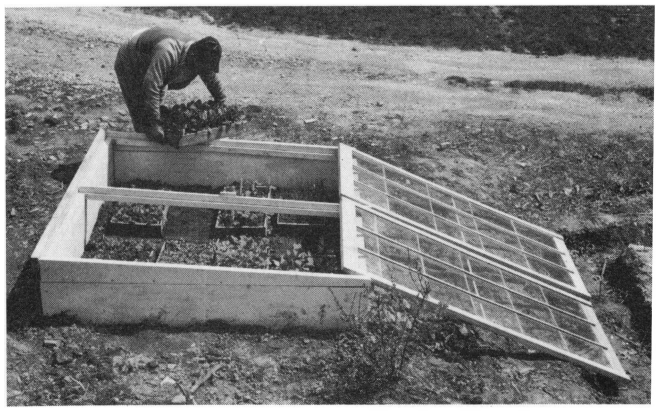
Prevention. Doctors do not know why some people seem to be more susceptible to colds than others. But they believe that certain conditions make it easier for people to "catch" colds. These conditions include chilling, overheating, exhaustion, and nervous fatigue. But, because viruses cause colds, exposure to a person with a cold is essential to transmission. Therefore, isolating persons who have colds is one of the best ways to prevent colds from spreading. Although scientists have developed several vaccines, none has proved effective against all types of colds. CLAYTON G. LOOSLI

See also COLD SORE.

COLD-BLOODED ANIMAL is an animal that has no built-in control over its body temperature. Many cold-blooded animals, including most water animals, are warm when their surroundings are warm, and cool when their surroundings are cool. All animals are cold-blooded except birds and mammals, which are warm-blooded.

Some cold-blooded animals control their body temperature to a certain extent by varying their activities. For example, the body of an active tuna or cecropia moth produces so much heat by muscular action that the animal becomes somewhat warmer than its surroundings. Most cold-blooded land animals adjust their body temperature by their behavior. They move into sunlight when they become too cool and move into shade when they become too warm. JAMES EDWARD HEATH

See also WARM-BLOODED ANIMAL.



U.S. Dept. of Agriculture

A Cold Frame is an unheated miniature greenhouse. It protects such plants as young cabbages, *above*, during brief cold periods.

COLD FRAME is a covered box built on the ground to protect growing plants. It has no bottom and may vary from 6 inches to 2 feet (15 to 61 centimeters) or more in height, depending on the kind of plant it contains. The top of a cold frame is made higher in the back to receive sunlight.

Different covers are used for different purposes. Glass or transparent plastic covers prolong the growing season by protecting plants from wind and cold. They may also be used to start plants early in the season. For plants that need shade, frames may be covered with spaced slats, burlap, or other material that reduces the amount of light entering the box. To protect plants during the winter, cold frames are covered with boards or straw mats. HENRY T. NORTHEN

COLD LANDS. See ANTARCTICA; ARCTIC; CLIMATE.

COLD SORE is a skin infection that usually appears around the mouth. The sore, caused by a virus, is called *herpes simplex*. This disease may appear anywhere on the body. It may be started by a fever, a cold, or sunburn. When the infection develops about the lips, it is called a cold sore or *fever blister*. The sore begins as a patch of redness that tingles and burns. Small yellowish blisters form in the area. They run together, break, ooze, and make a crust before healing begins. Most cold sores last from two to three weeks. No medicine will heal it, but a mild, nonirritating salve will ease the discomfort. RICHARD L. SUTTON, JR.

COLD STORAGE is a method of storing foods and other perishable products by holding them at low temperatures above freezing and in moist air. Low temperatures prevent spoilage by checking the growth of bacteria and chemical reactions. Household refrigerators, and the walk-in refrigerators used by grocers, butchers, and restaurants are examples of small-scale cold storage. Refrigerated warehouses are examples of large-scale cold storage. Furs are also kept in cold storage during the summer. Florists use cold storage to store flowers, plants, and bulbs. Pharmacists, physicians, and scientists use it to preserve drugs, serums, medicines, and specimens for research. See also FOOD, FROZEN; REFRIGERATION; CUDAHY, MICHAEL. JOHN T. R. NICKERSON

COLD TYPE. See PRINTING (Setting the Type).

Wide World

Berlin, a divided city in Communist-ruled East Germany, became a major symbol of the Cold War. In 1961, the Communists placed barbed wire across the Brandenburg Gate, *left,* closing the main route between East and West Berlin.

COLD WAR is the term used to describe the struggle between the Communist nations and the democratic nations that began after World War II. This struggle was called the *Cold War* because it did not lead to fighting, or "hot" war, on a wide scale.

The term *cold war* was used during the 1930's to describe Nazi Germany's methods of conquering nations with little fighting. After World War II ended in 1945, writers and political leaders began to use the term in its present meaning. Herbert Bayard Swope, an American journalist, suggested the term to statesman Bernard M. Baruch, who used it in a speech in April, 1946. A book called *The Cold War*, by the journalist Walter Lippmann, was published in 1947.

During World War II, the Communists and democracies fought as *allies* (partners) against the Axis powers—Germany, Italy, and Japan. The Allies defeated the Axis nations, but Great Britain, France, China, and Russia suffered terrible losses in gaining victory. The United States was by far the most powerful nation in the world. But Americans were tired of war and did not want to take on the burdens of world leadership. So the United States hastily reduced its armed forces.

On the other hand, the Soviet Union kept its huge armies in uniform. It distrusted the democracies. Russia wanted to be sure it had allies, and so it forced Eastern European countries to accept dictators who had been trained in Moscow. Russia also forced these countries to join the Communist *bloc* (group of nations). In addition, the Russians supplied arms and money to Communist revolutionaries throughout the world.

By 1947, the United States had become aware of the threat of Russian Communist expansion. The amount of Communist *infiltration* (secret entry) in the United States also alarmed many Americans.

Two great blocs came into being. The United States led the *Free World* nations. This group included Canada, France, Great Britain, West Germany, Japan, the Philippines, and many other countries of Western Europe and Latin America. Russia led the Communist bloc, which included Communist China (after 1949) and the Communist nations of Eastern Europe. The Communist bloc was often called the *East*, and the Free World bloc the *West*. The *nonaligned* or *neutral* nations—those in neither bloc—included India, Sweden, Switzerland, Indonesia, Cambodia, and most African states.

During the late 1940's and the 1950's, the Cold War became increasingly tense. Each side accused the other of wanting to rule the world. Each side believed its political and economic systems were better than the other's. Each strengthened its armed forces. Both sides viewed the Cold War as a dispute between right and wrong. They saw every revolt and every international incident as part of the Cold War. This situation made it difficult to settle any dispute peacefully through compromise, with each side giving up something. Fear grew among all peoples that a local conflict would touch off a third world war that might destroy mankind.

The nature of the Cold War began to change during the 1960's. Neither the East nor the West remained a *monolith* (united bloc). Communist China challenged Russia's leadership. The Chinese accused the Russians of betraying Communism and being secretly allied with

Carol L. Thompson, the contributor of this article, is the Editor of Current History *magazine.*

the United States. Some Communist countries followed China's leadership, and others remained loyal to Russia.

Among the nations of the Western bloc, France harshly criticized many U.S. policies and demanded independent leadership in Europe. West Germany also acted independently of U.S. policies. It searched for new economic and political relationships with other European countries, including East Germany.

Economic developments caused major shifts in the world balance of power during the 1960's. The rapid industrialization of Japan and West Germany made them important nations in the struggle for power. Their emergence and the growing strength of China led to new relationships. In 1970, Russian and West German leaders signed a treaty pledging peaceful relations between their nations. In 1971, China joined the United Nations (UN). Also in 1971, Great Britain and the European Economic Community (EEC), an economic association of Western European nations, agreed on terms for Britain's entry into the association. In 1972, the United States signed agreements with China and Russia to broaden contacts with those nations.

Some historians thought the developments of the 1960's and the early 1970's marked the end of the Cold War. But others believed the Cold War would continue as long as both Communism and democracy lasted. For a discussion of the principles of Communism and democracy, see the WORLD BOOK articles on COMMUNISM and DEMOCRACY.

The Coming of the Cold War

Historians do not agree on exactly when the Cold War began. Most believe it started shortly before or shortly after World War II ended in September, 1945. Others say it started with a speech by Premier Joseph Stalin of Russia in February, 1946. Stalin warned the Russian people that there would be wars as long as there were capitalist nations. He told the Russians they must "defend" themselves. Still other historians believe the Cold War began in 1947, when Russia tried to replace Germany and France as the strongest power in Europe.

The Alliance Breaks Up. In February, 1945, the leaders of the Allied *Big Three* met at Yalta in the Crimea. President Franklin D. Roosevelt of the United States and Prime Minister Winston Churchill of Great Britain reached agreement with Stalin on several issues. They set up *occupation zones* (areas controlled by the Allies) for postwar Germany, and worked out a plan to establish a new government in Poland. Stalin promised that Russia would go to war against Japan within three months after Germany surrendered. The three leaders also made plans to form the United Nations. See YALTA CONFERENCE.

Roosevelt died a few weeks after the Yalta Conference, and Harry S. Truman became President. Germany surrendered in May, 1945. The next month, delegates of 50 countries signed the United Nations Charter. See UNITED NATIONS (The San Francisco Conference).

Truman, Churchill, and Stalin met at Potsdam, near Berlin, in July, 1945. But just before the meeting, Churchill's Conservative Party was defeated in an election. Clement R. Attlee succeeded Churchill during the Potsdam Conference.

At Potsdam, the Allies agreed that the German people should be allowed to rebuild their lives "on a democratic and peaceful basis." However, serious disagreements arose. Great Britain and the United States charged that Russia was communizing the countries of Eastern Europe. Even before World War II ended, Russia had taken over the Baltic states of Latvia, Estonia, and Lithuania; parts of Poland, Finland, and Romania; and eastern Czechoslovakia. Russian troops occupied a third of Germany and all of Bulgaria, Hungary, Poland, and Romania. The Western nations also opposed a Russian proposal to give Poland nearly 40,000 square miles (100,000 square kilometers) of German territory. See POTSDAM CONFERENCE.

The Iron Curtain Descends. During 1945 and early in 1946, Russia cut off nearly all contacts between the West and the occupied territories of Eastern Europe. In March, 1946, Churchill warned that "an Iron Curtain has descended across the continent" of Europe. He made popular the phrase *Iron Curtain* to refer to Russia's barriers against the West. Behind these barriers, the Russians steadily expanded their power.

In 1946, Russia organized Communist governments in Bulgaria and Romania. In 1947, Communists took control of Hungary and Poland. Communists seized full power in Czechoslovakia early in 1948. These countries became Russian *satellites* (nations controlled by Russia).

Albania already had turned to Communism. Enver Hoxha, who led the Communist National Liberation Army in an Albanian civil war during World War II, established a Communist government in 1944.

Yugoslavia also joined the Communist bloc. The Communist Party of Yugoslavia had helped drive out the Germans near the end of the war. Yugoslav Communists led by Marshal Tito then took over the government.

East and West opposed each other in the United Nations. In 1946, Russia rejected a U.S. proposal for an international agency to control atomic energy production and research. The Soviet Union believed the United States had a lead in atomic weapons and would have a monopoly if controls were approved. The Russians pictured themselves as defenders of peace and accused the United States of planning a third world war.

See the History section of the articles on each Communist country mentioned in this section.

The West Holds the Line

The Containment Policy. In the fall of 1946, Greek Communists revolted against the Greek government. Great Britain had been giving military and economic aid to Greece. But the British told the United States they could no longer give enough help to the Greeks. The British also warned that they could not help Turkey resist Communist pressure.

In March, 1947, President Truman declared that the United States would help any free nation resist Communist *aggression* (attack). Congress granted his request for $400 million for aid to Greece and Turkey. With this aid, both Greece and Turkey successfully resisted Communism. The new American policy became known as the *Truman Doctrine*. Aimed at Soviet expansion in Europe, this doctrine developed into the *Containment Policy*, which was designed to *contain* (hold

back) Communist expansion throughout the world.

The foreign ministers of the United States, Great Britain, France, and Russia met in Moscow in March and April, 1947. They tried to draw up a German peace treaty. But the ministers could not agree on ways to end the occupation or on how to unify Germany.

The failure of the conference convinced U.S. Secretary of State George C. Marshall that Russia would not help Europe recover from World War II. In June, 1947, Marshall proposed giving U.S. economic aid to all European nations that would cooperate in plans for their own recovery. This proposal grew into the European Recovery Program, or Marshall Plan, which began in 1948. The United States believed that a strong, stable Western Europe would block the spread of Communism. Meanwhile, in September, 1947, Russia and eight other European Communist parties set up the *Cominform*, a new version of the Communist International. See MARSHALL PLAN; COMMUNISM (The Spread of Communism).

Czechoslovakia and Poland wanted to take part in the Marshall Plan, but Russia would not let them accept U.S. aid. Instead, Russia set up the Council for Mutual Economic Assistance (COMECON) in January, 1949. This organization was designed to unite the East European satellites economically and politically.

In June, 1948, the Western Allies announced plans to unify their German occupation zones and establish the West German Federal Republic (West Germany). West Germany was established in May, 1949. It had independence in some of its internal affairs, and it joined the Marshall Plan.

Also in June, 1948, Russia harshly criticized Tito, the Communist dictator of Yugoslavia. Tito then declared his country's independence from control by Russia.

The Berlin Blockade was Russia's answer to the West's plans for West Germany. In June, 1948, Soviet troops blocked all railroad, highway, and water traffic through East Germany to West Berlin. The city lay 110 miles (177 kilometers) inside the Russian occupation zone. The Russians thought their blockade would force the Western powers to leave Berlin. Then, the Russians believed, Europeans would lose faith in the United States.

Instead of pulling out of West Berlin, the Americans, British, and French set up the *Berlin airlift*. Day and night, for 11 months, Allied airplanes carried food and supplies to Berlin. The Russians lifted the blockade in May, 1949, and the Allies ended the airlift in September. The Berlin airlift showed the world that the United States would defend and support Western Europe. See BERLIN AIRLIFT.

The West Rearms. Military strength became more and more important in the late 1940's. During the Berlin blockade, the United States pledged continuing military aid to Western Europe. The United States, Canada, and 10 Western European nations signed the North Atlantic Treaty in April, 1949. This mutual defense treaty set up the North Atlantic Treaty Organization (NATO), a military alliance (see NORTH ATLANTIC TREATY ORGANIZATION). The NATO countries promised to defend West Germany and to prevent Russian expansion. In September, 1951, the United States signed the ANZUS mutual defense treaty with Australia and New Zealand (see ANZUS).

The nuclear arms race began on Aug. 29, 1949, when the Soviet Union tested an atomic bomb. Until then, the United States had been the only nation that knew how to make the atomic bomb.

Communist Expansion in Asia. During the 1940's, Communist strength increased in the Far East. The Russians had occupied Manchuria just before the end of World War II. After they left in 1946, the Chinese Communists took over most of northern Manchuria. The Russians also set up a North Korean "people's republic."

In China, Mao Tse-tung's Communist troops fought the Nationalist armies of Chiang Kai-shek. The United

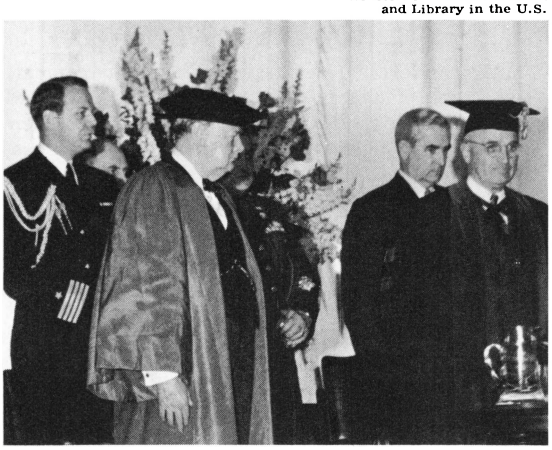
YEARS OF CRISIS

1946-1948 Communists Take Over Eastern Europe

1947 Truman Doctrine Announced By United States

Winston Churchill warned in a famous 1946 speech that an "Iron Curtain" had come down across Europe. President Harry S. Truman introduced the British prime minister to an audience at Westminster College in Fulton, Mo.

Winston Churchill Memorial and Library in the U.S.



The Greek Civil War ended in defeat for the Communist rebels. U.S. goods sent under the Truman Doctrine aided the victors.

United Press Int.

States gave military aid to Chiang. Late in 1949, Chiang and his government fled to the island of Taiwan. The conquest of China by Mao's forces put a nation of about 600 million persons into the bloc of Communist countries.

The Korean War. At the end of World War II, Russian troops occupied North Korea and United States forces occupied South Korea. The North Koreans had a strong army. They received Russian military aid even after Soviet troops withdrew from North Korea late in 1948. The United States withdrew its forces from South Korea in June, 1949.

North Korean troops invaded South Korea on June 25, 1950, and the Korean War began. On June 27, President Truman sent American forces to aid the South Koreans. At the request of the United States, the United Nations Security Council voted to send UN troops to help South Korea. The Russian delegation was *boycotting* (not attending) the council, and missed a chance to kill the decision by vetoing it. Seventeen nations contributed men to the UN force, and Chinese Communist troops aided the North Koreans.

Peace talks began in July, 1951. They went on for two years while bloody fighting continued. Finally, in July, 1953, representatives of the UN and the Communists signed a truce. In 1954, spokesmen for both sides met in Geneva, Switzerland, to discuss a political settlement. But they could not agree on a way to unite North and South Korea.

The Korean War was the first war in which troops of a world organization fought an aggressor nation. For the first time, Americans fought a "hot war" against Communism. Some historians believe the Korean War was a major turning point in the Cold War. It introduced limited warfare to the East-West conflict as a substitute to all-out—and possibly nuclear—war. Each side avoided attacking targets that could have led to expansion of the war. And each side limited the weapons it used and the territory in which it would fight. See KOREAN WAR.

To the Brink and Back

The Death of Stalin changed the character of the Cold War. The Russian leader died in March, 1953, two months after Dwight D. Eisenhower became President of the United States. The new rulers of Russia governed as a committee at first. Premier Georgi M. Malenkov and his associates adopted a softer policy toward Russia's satellites and the West. For example, they allowed the Russian wives of U.S. servicemen to follow their husbands to America. Russia also set up a cultural exchange program with the West. Soviet troops put down a revolt in East Germany in June, 1953, but Russia's softer course of action was obvious.

The arms race continued. The United States tested its first hydrogen bomb in November, 1952, and Russia set off its first H-bomb in August, 1953. Military alliances were strengthened during this period. In 1955, West Germany was allowed to join NATO. In response, Russia and its Eastern European satellites signed the Warsaw Mutual Defense Pact, a military alliance. Also in 1955, the United States announced its support of the military alliance of the Baghdad Pact, which later became the Central Treaty Organization. See CENTRAL TREATY ORGANIZATION; WARSAW PACT.

In January, 1954, the new U.S. secretary of state, John Foster Dulles, had outlined a new American military policy. The United States, he warned, would meet Communist aggression by "massive retaliation" with nuclear weapons. The United States, Dulles said, would strike back "at places and with means of our own choosing."

Cold War tensions increased in the Far East during 1954 and 1955. In Asia, the Chinese led the Communist push. The nationalist French Indochinese were led by Communists and supported by China. In the spring

1948-1949	1949	1949	1950-1953
Berlin Blockade Set Up by Russia	NATO Pact Signed By 12 Countries	Communists Win Control of China	Korean War—First Use Of UN Troops in Battle

The Berlin Airlift of 1948-1949 defeated an attempt by the Russians to force the Western Allies out of West Berlin.

United Press Int.

The Korean War ended in 1953 with a truce signed at Panmunjom. Fighting had continued during two years of peace talks.

Wide World

of 1954, after years of fighting, they defeated the French at Dien Bien Phu. A cease-fire agreement was signed in Geneva in July, 1954. It recognized the temporary division of Vietnam and gave North Vietnam to the Communists. Nationwide elections were to be held within two years. But neither the United States nor South Vietnam signed the agreement, and South Vietnam refused to hold the elections. The agreement also established the independence of Cambodia, Laos, and South Vietnam.

In September, 1954, the United States and seven other nations signed the Southeast Asia Collective Defense Treaty (see SOUTHEAST ASIA TREATY ORGANIZATION). This treaty was designed to prevent further Communist expansion in Southeast Asia. After the defeat of France in Indochina, the United States increased its aid to South Vietnam. The United States believed that if one Southeast Asian nation fell to Communism, the others would also topple over, one after another. This was called the "domino theory." But even with American support, South Vietnam could not defeat the Communist rebel forces, called Viet Cong, who were supported by North Vietnam. In 1955, the United States began sending military advisers to help the South Vietnamese government.

The United States also increased its support of the Chinese Nationalists on Taiwan. In September, 1954, the Chinese Communists staged air and artillery attacks against the islands of Quemoy and Matsu. These islands, in the Formosa Strait, were held by the Nationalist Chinese. In 1955, Congress voted to let President Eisenhower use armed force if necessary to protect the Chinese Nationalists.

The Spirit of Geneva. In Europe, a thaw in the Cold War became apparent in 1955. The Western Allies and Russia signed a peace treaty with Austria in May. Russian troops left that country, and Austria became an independent, neutral nation. That same month, Premier Nikita S. Khrushchev of Russia apologized publicly to Tito and resumed trade with Yugoslavia.

Eisenhower and Khrushchev met in Geneva in July. Eisenhower proposed that the United States and Russia permit air inspection of each other's military bases. Such an "open skies" agreement would prevent either side from launching a surprise attack on the other. Khrushchev rejected the proposal. But both leaders agreed that an atomic war would be a disaster for both sides. Political observers began to write of a "big thaw" in East-West relations and called it the "spirit of Geneva."

After the Geneva conference, Russia announced a cut of 640,000 men in its armed forces. The Russians said they also had reduced the armies of their satellites. Khrushchev toured Afghanistan, Burma, and India, and offered them economic and technical aid.

Dulles still distrusted the Russians in spite of their softer line. In January, 1956, he told the American people that the United States had been on the brink of war several times. "If you are scared to go to the brink, you are lost," Dulles warned. The use of "brinkmanship" had become part of U.S. policy.

In February, 1956, Khrushchev called for *peaceful coexistence* (competition without war) between East and West. He also began a campaign of *destalinization* (removal of Stalinist influences) in Russia and its satellites. In April, 1956, Russia dissolved the Cominform.

Unrest in Eastern Europe. The new Soviet policy encouraged the peoples of Eastern Europe to expect more freedom from Russian rule. In Poland, riots and strikes broke out in Poznań in June, 1956, and spread to other cities. The rioters demanded a more liberal government and an end to Russian rule. A few months later, the Russians allowed Władysław Gomułka, a Polish Communist leader, to rejoin the Polish Communist Party. The Russians had jailed Gomułka in 1951 for trying to set up an independent Communist government in Poland. Khrushchev and other Russian leaders flew to Warsaw to confer with Gomułka in October, 1956. Faced with further rebellion, the Russians agreed to relax some controls in Poland. See POLAND (Communist Rule).

In Hungary, a revolt against Communism began in October, 1956. A rebel government led by Imre Nagy demanded withdrawal of all Russian troops. Early in November, Russian tanks rolled into Budapest. The fighting spread to all parts of the country, and thousands of Hungarian "freedom fighters" were killed. The Russians smashed the revolt in about two weeks. In spite of the new Soviet policy, Russia could not allow Hungary to break up the bloc of Eastern European satellites. See HUNGARY (Communist Hungary).

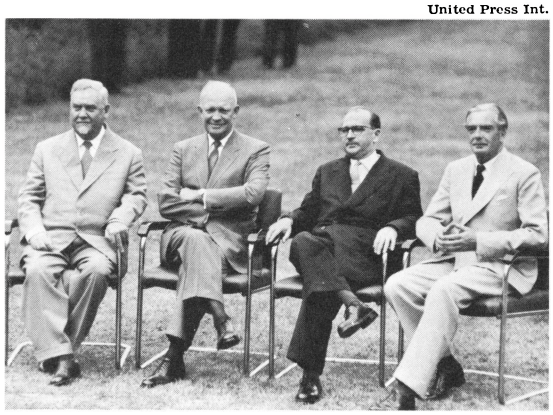
Trouble at Suez. During the period that Russia was putting down unrest in its Eastern European satellites, trouble was stirring in the Middle East. The United States was trying to prevent Communist expansion in that area. Both Russia and the West sought Egypt's support by offering aid for its development plans. Each side offered to help build the Aswan High Dam. After Egypt courted Communist aid for the dam and bought Communist arms, the United States and Great Britain canceled their offers to help with the project. President Gamal Abdel Nasser of Egypt struck back by seizing

✶ 1953 — Death of Stalin Alters Cold War

✶ 1955 — Summit Conference Held in Geneva

At the Geneva Conference, President Dwight D. Eisenhower, *second from left,* met with Russian, French, and British leaders.

United Press Int.



the Suez Canal from international control. Nasser said Egypt would use the profits from operating the canal to build the dam "without pressure from any nation." But he did accept Russian aid.

In October, 1956, while Russia was involved with the Hungarian revolt, Israel invaded Egypt. Britain and France immediately joined in the attack. They wanted to return the Suez Canal to international control. The United States and Russia supported a United Nations resolution demanding an immediate truce. In addition, Russia threatened to send troops to help Egypt. The UN arranged a truce after a few days of fighting. But Russia, by backing Egypt against Israel, had won friends among the Arab nations of the Middle East.

New Challenges

Khrushchev's power in Russia reached its peak in the late 1950's. Sometimes the Russians followed a hard policy, mainly in response to China's challenge to Soviet leadership of the Communist bloc. At other times, Russia stressed peaceful coexistence, giving special attention to economic aid and scientific progress. But the Soviet Union continued to encourage riots, strikes, and revolts in non-Communist countries. And it still called for "wars of liberation." In the West, "peaceful coexistence" came to mean Communist efforts to conquer countries without a major war.

The Missile Gap. The Russians improved their ability to produce nuclear weapons, and the Free World feared a missile gap, or Soviet rocket superiority. In June, 1957, the Russians successfully tested an intercontinental ballistic missile (ICBM). That same year, they launched the first man-made earth satellite, *Sputnik I.* In January, 1958, the United States launched its first earth satellite. Russian rocket power was more advanced, but the two powers had clearly established a nuclear "balance of terror." A brief thaw in the Cold War followed. Russia stopped testing nuclear weapons in March, 1958, and the United States halted its tests in October.

The Eisenhower Doctrine was approved by Congress in March, 1957, because the United States feared Communist penetration in the Middle East. This policy permitted the President to "use armed force to assist any . . . nation . . . [in the Middle East] requesting assistance against armed aggression from any country controlled by international Communism."

In July, 1958, a revolution ended the rule of the pro-Western government of Iraq. The new government favored Communism. Nearby Lebanon feared a Communist revolution and asked the United States for aid. President Eisenhower quickly sent about 6,000 sailors and marines to help Lebanon. Great Britain sent paratroopers to protect Jordan against Iraqi pressure. In spite of Russian protests, the American and British forces stayed in the Middle East for about three months.

The Far East. In 1958, the Chinese Communists again fired on Quemoy and Matsu, Taiwan's offshore islands. Dulles warned that any attack on these islands would be considered aggression against Nationalist China, an ally of the United States. But occasional firing continued during the 1960's.

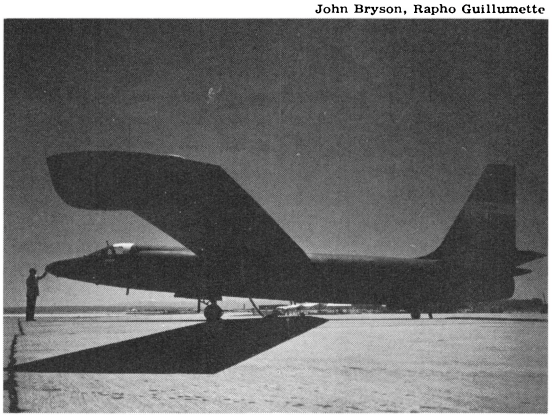
Germany. During the late 1950's, Europe remained the most important Cold War battleground. The Russians tried repeatedly to damage the reputation of the West in Germany. In November, 1958, they demanded peace treaties for East and West Germany. Such treaties would have ended the military occupation, and Western troops would have had to leave. The United States refused to yield to the Russian demand, and kept its forces in Berlin. As a result, the Russians kept threatening to sign a separate peace treaty with the East German government.

The Spirit of Camp David. Another temporary thaw in the Cold War began in the spring of 1959. The foreign ministers of the United States, Great Britain,

1957	1960	1961	1961
Eisenhower Doctrine Announced by United States	Russia Downs U-2 Spy Plane	German Communists Build Berlin Wall	Castro Announces He Is a Communist

A U.S. Spy Plane was shot down over Russia in 1960, and the Russians canceled a summit meeting with the United States.

John Bryson, Rapho Guillumette



Fidel Castro, *left,* declared his Cuban government was Communist, and was welcomed to Russia by Premier Nikita S. Khrushchev.

Wide World

France, and Russia met in May. In July, Vice-President Richard M. Nixon visited Russia and met with Khrushchev. Two months later, Khrushchev visited the United States. He conferred with Eisenhower at Camp David in Maryland. Khrushchev was so friendly that observers spoke of the "spirit of Camp David," recalling the earlier "spirit of Geneva." Eisenhower and Khrushchev discussed a *summit* (top-level) conference to be held in Paris in 1960. The President accepted Khrushchev's invitation to visit the Soviet Union after the summit meeting.

The U-2 Incident abruptly ended the thaw. An American U-2 spy plane was shot down in Russia in May, 1960. The Russians captured the pilot, Francis Gary Powers, who confessed he was a spy. Eisenhower accepted personal responsibility for the flight. He admitted that U-2 planes had been flying over Russia taking photographs for four years.

When the summit conference began on May 15, Khrushchev demanded that Eisenhower apologize for the U-2 incident. Eisenhower refused, and Khrushchev angrily canceled his invitation for the President to visit Russia. Khrushchev then left the conference, which broke up the next day.

Africa. The Cold War struggle moved to Africa in July, 1960. Premier Patrice Lumumba of the Congo asked the UN to deal with a revolt in his newly independent nation. He charged that the Belgians were aiding the rebel Katangans. The Russians sided with Lumumba against a group led by Congolese President Joseph Kasavubu. The UN intervened in the dispute, keeping Russia and the West from direct military action in the troubled Congo. The Russians charged that the UN favored the West.

The Troika Proposal. In September, 1960, Khrushchev went to New York City for the meeting of the UN General Assembly. He again criticized the United States for the U-2 flights. The Russian leader showed his anger by taking off a shoe and pounding his desk with it.

Khrushchev tried to destroy the power of the UN to send troops into the world's trouble spots. He called for three secretaries-general—a *troika* (a Russian term for a vehicle drawn by three horses)—to replace the UN secretary-general. One would be a Communist, one from a neutral nation, and one from the West. The General Assembly defeated the proposal.

The Bay of Pigs. John F. Kennedy became President of the United States in January, 1961. Cold War tensions were high—in Europe, in Asia, and even on the doorstep of the United States, in Cuba.

The Cuban government of Fidel Castro had become openly Communist in 1960. Castro condemned the United States and began to receive military aid from Russia and other Communist countries. The Cuban government seized millions of dollars' worth of American property in Cuba. The United States ended diplomatic relations with Cuba in January, 1961.

In April, 1961, the United States sponsored an invasion of Cuba by anti-Castro Cubans at the Bay of Pigs. The attack was poorly planned and failed badly. The unsuccessful invasion strengthened Castro's control of Cuba, and the United States lost face.

The Berlin Wall. Kennedy and Khrushchev met in Vienna, Austria, in June, 1961. Khrushchev demanded a free Berlin and an end of the military occupation. The two leaders failed to reach agreement, and Khrushchev again threatened to sign a separate peace treaty with East Germany. The next month, Russia canceled cuts in its armed forces and increased its military spending.

Growing numbers of East Germans were fleeing to West Germany. On Aug. 13, 1961, the East German Communists began to build a wall of cement and barbed wire between East and West Berlin. To confirm the West's right to stay in West Berlin, the United States sent troops to the city by highway. American tanks enforced Western rights to enter East Berlin without showing papers to Communist border guards. Some East Germans escaped to West Berlin after the wall was built, but many were killed in the attempt. The wall remained, splitting Berlin in two. See BERLIN.

The Space Race Begins. On April 12, 1961, a Russian spaceman, Yuri Gagarin, made the first flight in space around the earth. Later that year, Alan B. Shepard, Jr., and Virgil I. Grissom piloted American spaceships. In 1962, astronaut John H. Glenn, Jr., became the first American to circle the earth in space.

In September, 1961, Russia ignored an unofficial agreement against nuclear weapons tests, and resumed nuclear bomb testing in the atmosphere. The United States then resumed underground testing. American tests above ground were started again in April, 1962.

The Cuban Missile Crisis. In October, 1962, the United States learned that Russia had secretly installed missiles and missile bases in Cuba, about 90 miles (140 kilometers) from Florida. President Kennedy demanded that Russia remove the missiles and bases. He set up a naval "quarantine" of Cuba. Russia tried to bargain, and offered to remove the missiles if the United States would dismantle its military bases in Turkey. The United States refused. After a week of extreme tension,

★ 1964

Communist China Explodes Atomic Bomb

United States Bombs Bases in North Vietnam

U.S. Marines Entered the Vietnam War in 1965, increasing the number of American troops in Vietnam at that time to 27,000.

Francois Sully, *Newsweek*

Khrushchev agreed to remove the missiles. See CUBA (History).

Easing Cold War Tensions

After the missile crisis in Cuba, Cold War tensions again eased. In July, 1963, the United States, Russia, and Great Britain approved a treaty to stop the testing of nuclear weapons in the atmosphere, in outer space, and under water. In August, the United States and Russia set up a *hot line* between the White House and the Kremlin. This direct communications link was installed to reduce the risk of accidental nuclear war. In October, the UN unanimously adopted a resolution forbidding the use of nuclear weapons in outer space.

Direct relations between Russia and the United States also improved. In 1963, Russia faced a serious shortage of grain. Kennedy approved a plan to sell the Russians $250 million worth of American wheat. That same year, the two nations agreed to cooperate in space projects using weather and communications satellites.

President Lyndon B. Johnson, who became Chief Executive after Kennedy was assassinated in November, 1963, continued to work for peaceful coexistence. In 1964, the United States and Russia signed their first *bilateral* (two-nation) treaty. It provided that a *consul* (representative) of each nation would have an office in a city of the other country. It also provided protection for Americans traveling in Russia, and for Russians traveling in the United States. The U.S. Senate approved the treaty in 1967, and Russia approved it in 1968. The two nations also extended an agreement for educational, scientific, and cultural exchanges.

The Shifting Cold War Battleground

The character of the Cold War changed again in the mid-1960's. The United States and Russia each had enough nuclear weapons to wipe out the entire world. Each had an antimissile defense system. But both powers realized that there would be no victor in an all-out nuclear war. At the same time, conflicts within both the Communist and Free World blocs changed the two-sided nature of the balance of power.

The Great Blocs Split. Following Russia's destalinization campaign, the Soviet Union and Communist China began to move along different paths. Disagreements within the Communist bloc became more and more apparent during the 1960's. In 1960, at the third Congress of the Romanian Communist Party, the Russians and Chinese quarreled bitterly and openly. Russia soon cut off technical aid to China. When China attacked India in 1962, Russia supported India. Russia again backed India when Pakistan and India fought in 1965. China threatened India and aided Pakistan.

After Khrushchev fell from power in October, 1964, Russia's new leaders tried to heal the split with China. But Premier Aleksei N. Kosygin and General Secretary Leonid I. Brezhnev were unable to reunite the Communist bloc.

In 1966, China launched a "cultural revolution." One aim of this revolution was to eliminate all Russian influence from China. The Chinese accused the Russians of betraying world Communism and being secret allies of the United States. The Chinese threat to the Soviet Union became more real when China exploded its first hydrogen bomb in June, 1967.

In March, 1969, Russian and Chinese troops began to fight each other on an island in the frozen Ussuri River. This river is the border between Chinese Manchuria and Russia's maritime territories. Both countries claimed they owned the island. The border controversy continued into the early 1970's.

Some of Russia's satellites also shifted their loyalty. Albania had sided with China in 1961, and neither China nor Albania attended the 23rd Communist Party Congress in Moscow in 1965. Yugoslavia remained independent, with its own brand of "national Com-

✶ 1966 France Withdraws Troops from NATO

✶ 1966 China Accuses Russia of Betrayal

✶ 1967 Johnson and Kosygin Meet in Glassboro, N.J.

✶ 1972 Nixon Meets with Chinese Leaders

President Lyndon B. Johnson, *right,* and Russian Premier Aleksei N. Kosygin conferred in Glassboro, N.J., in 1967.

Pictorial Parade

President Richard M. Nixon, *right,* was welcomed to Peking in 1972 by Premier Chou En-lai of China and an honor guard.

Wide World

munism." Other Communist nations, including Romania, Poland, and Cuba, loosened their ties with Russia.

Differences also sharpened among the Western nations. President Charles de Gaulle of France challenged the leadership of the United States and Great Britain. France established diplomatic relations with China in 1964, and sharply criticized U.S. policy in the Vietnam War. At De Gaulle's request, NATO moved its military headquarters from France in 1967, and the French withdrew their troops from the alliance. France also blocked Great Britain's entry into the European Economic Community (EEC). In 1967, De Gaulle further strengthened France's relations with Russia and Eastern Europe. In June of that year, France sided with the Arabs against Israel in the Arab-Israeli War. In 1968, France exploded a hydrogen bomb.

The Growing Strength of Europe was another factor in the changing nature of the Cold War. More than 20 years after the end of World War II, the nations of Western Europe were enjoying prosperity. The EEC, also called the European Common Market, had become a powerful economic force. Western European nations gradually increased trade with Communist countries. Many Western European leaders worried more about Germany's return to power than about Russia.

Soviet-American Relations in the 1960's reflected the changing nature of the Cold War. In 1966, Russia and the United States agreed to permit direct air service between Moscow and New York City. By January, 1967, they and 60 other nations had signed the first international treaty providing for the peaceful exploration and use of outer space.

President Johnson and Premier Kosygin met for the first time in June, 1967. Kosygin went to the United States to address the UN General Assembly. The two leaders met in Glassboro, N.J., and discussed the Vietnam War, the Arab-Israeli dispute, and disarmament.

In August, 1967, Russia and the United States submitted proposals at the Geneva Disarmament Conference for a treaty to prevent the spread of nuclear weapons. In 1968, they agreed on an addition to the treaty providing for international inspection and controls. France refused to sign the treaty. The U.S. Senate approved it in 1969. The treaty went into effect on March 5, 1970, after being *ratified* (formally approved) by the United States, Russia, Great Britain, and more than 40 other nations.

In 1969, Russian and U.S. representatives began a series of Strategic Arms Limitation Talks (SALT). The representatives worked toward an agreement to control the production of nuclear weapons.

The Invasion of Czechoslovakia. Hopes for an easing of Cold War tensions in Europe were jolted in August, 1968, when Soviet, Bulgarian, East German, Hungarian, and Polish troops invaded Czechoslovakia. The invasion halted a move by the Czech government to give more individual freedom to the Czech people. In October, Czechoslovakia and Russia signed a treaty that allowed Soviet troops to remain and assured that Czechoslovakia would continue as a Russian satellite.

The Battle for the Neutral Nations continued in the 1960's. In Latin America, the United States still guarded against Communist aggression. In April and May, 1965, the United States, at the request of the Dominican Republic, sent troops to the Dominican Republic to prevent a Communist take-over during a revolt there. The crisis eased, and the U.S. troops left.

In the Middle East, a six-day war broke out between Israel and the Arab powers in June, 1967. The United States supported the Israelis, and Russia backed the Arabs. Russia helped arm the Arabs before the war began, but this did not prevent their defeat. Scattered fighting continued in the late 1960's. The United States and Russia increased aid to the opposing sides.

In Africa, most of the newly independent nations maintained their neutrality. These nations took aid from all the major Cold War powers.

The Vietnam War threatened to turn the Cold War into a general hot war. During the early 1960's, the United States stepped up its support of South Vietnam against the Communist Viet Cong forces. The United States blamed the struggle on Communist North Vietnam, viewing the war as "aggression from the north."

The United States gradually *escalated* (increased) its military effort. In 1965, it began large-scale bombing of North Vietnam. By 1968, over 500,000 U.S. troops were in Vietnam. The Viet Cong and North Vietnamese received war materials from Russia and China.

The fighting spread throughout Indochina. Cambodia and Laos, both of which border South Vietnam, tried to stay neutral. But Communist forces used both countries as bases for raids into South Vietnam, and the two nations were drawn into the war. Thailand backed the West in the struggle. The United States used bases there for bombing raids on North Vietnam.

Peace talks started in Paris in May, 1968. But the talks stalled, and the fighting went on. In 1969, the United States established new training programs to help the South Vietnamese take over most of the fighting. This policy became known as *Vietnamization*. Also in 1969, President Richard M. Nixon began to gradually reduce the number of U.S. soldiers in Vietnam. In January, 1973, the participants in the war signed a cease-fire agreement. All remaining U.S. ground forces were then removed from Vietnam. See VIETNAM WAR.

The Cold War Today

The loosening of ties among members of both the Communist and Free World blocs during the 1960's led to new international relationships in the 1970's. Several Communist and democratic nations developed friendlier relations with one another, helping ease Cold War tensions. As a result, historians began to disagree on the status of the Cold War.

New Relationships. In 1970, West Germany and Poland signed a treaty to reject the use of force and to recognize the boundaries created in Europe after World War II. West Germany and Russia ratified a similar treaty in 1972.

The status of West Berlin, a major Cold War problem, was settled in the early 1970's. France, Great Britain, Russia, and the United States signed an agreement in 1971 stating that West Berlin is not part of West Germany. The Berlin agreement also provided for free movement of traffic between West Germany and West Berlin. The pact took effect in 1972, after East Ger-

many and West Germany worked out the details. In 1973, East and West Germany became members of the United Nations.

In 1971, Great Britain finally gained approval for admission into the European Common Market. The increased economic ties among the Common Market nations made Western Europe a major trading bloc and a powerful, independent force in world affairs. Japan, which became an industrial power during the 1960's, also began acting more independently of U.S. policies. The Japanese based their new outlook partly on hopes of improving relations with China.

China's relations with the West improved in the early 1970's. Canada and several other Western nations established diplomatic relations with Communist China for the first time. China was admitted to the United Nations in October, 1971. Also in 1971, leaders of both China and Russia invited Nixon to visit their countries for high-level talks. In February, 1972, Nixon visited China for seven days. The visit ended with an agreement by Nixon and Chinese Premier Chou En-lai to increase contacts between their two countries. In May, Nixon visited Russia for nine days. During this trip, Nixon and Leonid I. Brezhnev, leader of the Soviet Communist Party, signed agreements to limit the production of U.S. and Soviet nuclear weapons. These agreements had been the chief goals of the SALT meetings between representatives of the two nations.

The Cold War As History. In the changing atmosphere of the 1970's, the superpowers continued to take sides in such troubled areas as Indochina and the Middle East. Historians differed on whether these actions were related to the Cold War.

The shift in the world balance of power convinced some historians that the Cold War had ended. These scholars viewed the Cold War as a struggle between two unified blocs to gain control over Europe and Asia. They thought the struggle ended when Europe and Japan became strong and China joined the United Nations. Other historians regarded the Cold War as a continuing struggle between Communist nations trying to spread Communism and democratic nations determined to contain it. These historians believed the contest would continue as long as both Communism and democracy existed.

CAROL L. THOMPSON

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Outline

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- A. The Containment Policy
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- C. The West Rearms
- D. Communist Expansion in Asia
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VII. The Cold War Today
- A. New Relationships
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Questions

What situation made it difficult for the Communists and the democracies to settle any dispute peacefully during the late 1940's and the 1950's?

Where did U.S. troops fight troops of a major Communist power for the first time?

How did the death of Stalin affect the Cold War?

What was the "spirit of Geneva"?

What is the *Iron Curtain?* The *containment policy?*

Why did some historians view the Korean War as a major turning point in the Cold War?

Why did the Russians blockade Berlin in 1948? Why did they build the Berlin wall in 1961?

What was the U-2 incident? How did it affect the Cold War?

How did France challenge the United States and Great Britain for leadership of the West?

Why did the character of the Cold War change during the mid-1960's?

Reading and Study Guide

See *Cold War* in the RESEARCH GUIDE/INDEX, Volume 22, for a *Reading and Study Guide.*

The Metropolitan Museum of Art, New York City, gift of Mrs. Russell Sage, 1908

Thomas Cole's *The Oxbow*, painted in 1836, shows the treatment of nature that was typical of his early works. Most of Cole's later paintings were more dramatic and dealt with moral and symbolic themes.

COLE, THOMAS (1801-1848), was a leader of the first American group of landscape painters, the Hudson River school. His most notable paintings are the four canvases of *The Voyage of Life* and the five titled *The Course of Empire*, elaborate allegories in romantic realism. Cole was born in Lancashire, England. He went to Philadelphia in 1819, and then to Ohio as a traveling portrait painter. In 1823, Cole returned to Philadelphia to study at the Pennsylvania Academy. He went to Europe in 1829 and in 1841. Many scenes in his paintings came from his European studies. EDWIN L. FULWIDER

COLEMAN, WILLIAM THADDEUS, JR. (1920-), became United States secretary of transportation in 1975. Coleman, appointed by President Gerald R. Ford, was the second black Cabinet member in the nation's history. The first was Robert Weaver, who was secretary of housing and urban development from 1966 to 1969. As secretary of transportation, Coleman worked to help the bankrupt railroads in the Northeastern United States solve their financial problems. His program also included helping cities improve their transportation systems.

United Press Int.

William T. Coleman, Jr.

Coleman ranks as a leading expert in transportation law. From 1952 to 1963, he served the Philadelphia city government as an attorney on transportation matters. He held a similar position in a Pennsylvania state transportation agency from 1968 to 1975. Coleman also is a leader in the civil rights movement. He helped write the legal argument that resulted in the 1954 decision by the Supreme Court of the United States banning segregation in public schools.

Coleman was born in Philadelphia. He graduated from the University of Pennsylvania in 1941 and from the Harvard Law School in 1946. HELEN THOMAS

COLEOPTERA, the largest order of insects, contains more than 280,000 species. This order includes the beetles, weevils, and fireflies. See BEETLE with its list of *Related Articles;* FIREFLY; WEEVIL; INSECT (table).

COLERIDGE, SAMUEL TAYLOR (1772-1834), was a poet and philosopher-critic of the English romantic movement. His major poems are among the most original in English. His poem "The Rime of the Ancient Mariner" is one of the greatest in English literature. His literary criticism has influenced nearly all later critics.

His Life. Coleridge was born in Devonshire, the youngest of about 14 children of a clergyman. He studied at Cambridge University, where he met Robert Southey in 1794. The two young poets favored the principles of the French Revolution and planned to found a *pantisocracy* (a utopian society) in America. They also collaborated in 1794 on a drama opposing monarchy.

In 1795, Coleridge met William Wordsworth, and they became intimate friends. Together they published *Lyrical Ballads* (1798), which contains the first version of "The Rime of the Ancient Mariner." In 1798, Coleridge received an *annuity* (regular income) from Josiah and Thomas Wedgwood, which enabled him to travel to Germany. There he absorbed ideas from German philosophers that influenced his own literary theories. On his return to England, he translated two plays by the German author Friedrich Schiller.

About 1800, Coleridge's health began to fail seriously. He had begun taking opium to relieve the pain of rheumatism. His marriage, never happy, also caused him increasing distress after he fell in love with Wordsworth's sister-in-law, Sara Hutchinson. Coleridge sought relief from his suffering in drugs and travel. He delivered a series of lectures in London on the principles of poetry. He then founded a short-lived periodical, *The Friend.* In 1813, he delivered another important series of lectures and produced his play *Remorse* with the aid of Lord Byron. Coleridge spent his last years under a doctor's

care, largely to control his addiction to opium.

His Writing. Coleridge's other famous poems are "Kubla Khan" and "Christabel." Coleridge said, possibly incorrectly, that "Kubla Khan" was inspired by an opium dream. "Christabel" is an unfinished narrative of medieval times. Both poems deal with the visionary and the supernatural. Each combines dreamlike vividness of imagery with rich literary references and intricate symbolism.

Detail of oil painting by Washington Allston, National Portrait Gallery, London

Samuel Taylor Coleridge

Coleridge blended keen psychological insights with precise pictures of natural scenes in his meditative lyrics, notably "Frost at Midnight," "This Lime Tree Bower My Prison," and "Dejection: An Ode."

In his literary criticism, Coleridge established the principle that a good poem is an organic, not a mechanical, unity. Therefore, a poem cannot be *paraphrased* (expressed in other words). He emphasized that poetry is creative or expressive, rather than imitative, and insisted that imagination, rather than reason, is the foundation of the fine arts.

Coleridge's best-known work of criticism, *Biographia Literaria* (1817), contains valuable analyses of Wordsworth's poetry. Many of Coleridge's shrewdest critical comments appear in his notebooks, lectures, journalistic essays, and marginal comments on other writers' works. A devout man, he wrote and talked much about religion, morality, and theology. His ideas influenced religious thought throughout the 1800's. KARL KROEBER

COLETTE (1873-1954) was a French author. She was one of her country's few modern novelists who expressed a closeness to nature in her writing. Her mother had taught her tenderness for every plant and animal, and Colette expressed these feelings in her writing. Her style is sensitive and sensual and brings out the perfumes and colors of her native region of Burgundy. She also portrayed Parisian life.

Wide World

Colette

Colette is especially noted for her portraits of women in love and of jealous women. Her novels reflect her own life in the early 1900's. But she saved her characters and situations from appearing outdated by the candor and vitality of her insight into human nature.

Colette was born Sidonie-Gabrielle Colette in St.-Sauveue-en-Puisaye, near Auxerre. Her first works were four autobiographical novels (1900-1904) about a girl named Claudine. Her other novels include *The Vagabond* (1910), *Chéri* (1920), *The Ripening* (1923), *Sido* (1929), *The Cat* (1933), and *Gigi* (1945). EDITH KERN

COLEUS is a large group of showy foliage plants, native to the African and Indian tropics. Coleuses grow as high as 3 feet (91 centimeters), and have many-colored leaves.

Scientific Classification. The coleus belongs to the mint family, *Labiatae*. It forms the genus *Coleus*.

COLFAX, SCHUYLER (1823-1885), served as Vice-President of the United States from 1869 to 1873, during the first term of President Ulysses S. Grant. He also was an active leader of the Whig and Republican parties and a prominent member of Congress.

Colfax was elected to the United States House of Representatives in 1855, and remained there for 14 years. He joined the new Republican Party and became Speaker of the House in 1863. Colfax held the post until he was inaugurated Vice-President. He was born in New York City. IRVING G. WILLIAMS

See also CREDIT MOBILIER OF AMERICA; VICE-PRESIDENT OF THE UNITED STATES (picture).

COLGATE UNIVERSITY. See UNIVERSITIES AND COLLEGES (table).

COLIC, *KAHL ihk*, is a severe cramping pain in an abdominal organ. Many babies and some children and adults suffer from colic. Physicians do not fully understand the causes of such pains, especially in babies. The disease may occur if the baby's digestive system has not developed enough to handle its food properly. Indigestion or constipation may cause gas to form in the intestines, resulting in colic. Some persons develop colic as a result of emotional tension. The disorder may also be caused by arsenic or lead poisoning, blood diseases, gallstones, kidney stones, narrowing of the intestine, intestinal worms, or appendicitis.

Treatment for colic depends on the cause. Giving a baby a pacifier may help reduce tension. Patting a baby's back gently may help the baby expel gas. In some cases, it may be necessary to change the kind or amount of a baby's food. In most cases, babies outgrow the disease. A physician should be notified if colic pain persists. Adults who suffer from colic may require psychiatric counseling. HYMAN S. RUBINSTEIN

COLIGNY, GASPARD DE. See HUGUENOTS.

COLIMA, *koh LEE mah*, is a small Mexican state. It has a population of 241,153 and an area of 2,106 square miles (5,455 square kilometers). Colima lies west of Mexico City, between the Pacific Ocean and the Sierra Madre mountains. For location, see MEXICO (political map). A low coastal plain covers most of the state. Sandy beaches lie along the coast. Colima farmers grow corn, rice, sugar cane, and citrus fruits. Ranchers raise sheep, goats, and horses. The state was named for its capital, which was founded in 1522. Colima became a state in 1857. CHARLES C. CUMBERLAND

COLINES, SIMON DE. See BOOK (Printed Books).

COLISEUM, an alternate spelling. See COLOSSEUM.

COLITIS, *koh LY tihs*, is a disease involving inflammation of the colon or other parts of the large intestine. There are several different kinds of colitis. *Ulcerative colitis* may follow attacks of amebic or bacillary dysentery. But in many cases, doctors do not know the cause of the illness. Persons with ulcerative colitis may have rectal bleeding, diarrhea, cramping abdominal pain, fever, and loss of appetite. Ulcers form in the intestine. Surgical treatment may be required. Doctors believe that when this type of colitis continues for a long time,

the patient may become more susceptible to cancer of the colon than he otherwise would be.

Other kinds of colitis are *mucous colitis* and the *irritable bowel syndrome*, or *spastic colon*. These result from disturbances of the normal function of the colon. Persons with these conditions have severe diarrhea with the passage of mucus. A doctor should be consulted when any of these conditions occur. E. Clinton Texter, Jr.

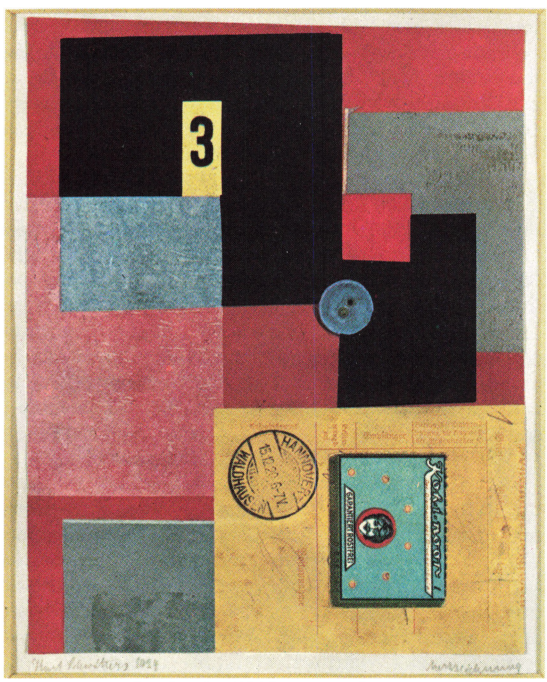
See also Colon; Diarrhea; Dysentery.

COLLAGE, *kuh LAHZH*, is a picture or design made by gluing pieces of paper or other materials onto a canvas or another surface. The term comes from the French word *coller*, meaning *to paste* or *to glue*.

Most artists use such common items as photographs and ticket stubs to make collages. The pasted materials may be combined with lines and colors painted by the artist. By arranging the materials in a certain way, an artist can create strange or witty effects not possible in traditional painting.

Some painters use collage to develop color compositions. For example, an artist can move a piece of colored paper over parts of his picture until the color is just where he wants it. Art students use collage techniques to study proportion and color relationships. Many elementary schools include collage in their art courses.

Modern artists began experimenting with collage about 1912. Georges Braque, Juan Gris, and Pablo Picasso created paintings onto which they pasted pieces of paper, oilcloth, or wallpaper. In *The Bottle of Anis del Mono*, Gris used pieces of newspaper and a liquor bottle label. This picture appears in the Painting article. Beginning about 1920, such painters as Max Ernst cut out book and magazine illustrations for collages. They pasted parts of one picture onto sections of another to create mysterious fantasies. Reed Kay



Merz Drawing (1924) by Kurt Schwitters; The Museum of Modern Art, New York City, Katherine S. Dreier Bequest

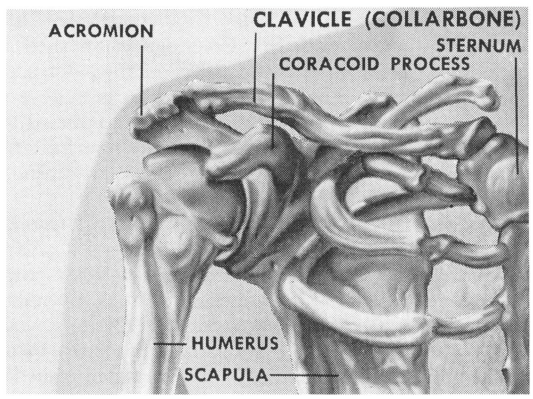
Collages broke down traditional differences between painting and sculpture and influenced many art styles of the mid-1900's.

COLLAGEN DISEASES. See Rheumatism.

COLLAMER, JACOB (1791-1865), an American statesman, was postmaster general for one year under President Zachary Taylor. Collamer also served in the U.S. House of Representatives from 1843 to 1849 and in the U.S. Senate from 1855 until his death.

Collamer, a Republican, was born in Troy, N.Y. He graduated from the University of Vermont in 1810, and served in the Vermont legislature. A statue of him represents Vermont in the U.S. Capitol. Arthur A. Ekirch, Jr.

COLLARBONE is a long, slender, curved bone that connects the breastbone with a hooklike projection on the shoulder blade. The technical name for the collarbone is *clavicle*. The breastbone is properly called the *sternum*, the hooklike projection, *acromion*, and the shoulder blade, *scapula*.



Collarbone, or Clavicle, Forms Part of the Shoulder.

Man has two collarbones, one directly in from each shoulder. The bones are shaped somewhat like the italic letter *f*. Collarbones hold the arms in proper position at the sides of the body. When a person breaks a collarbone, his shoulder drops downward and forward toward the chest. Most broken collarbones are caused by falling on outstretched arms. A hard blow on the shoulder may dislocate the outer end of a collarbone.

Animals that walk on four legs, such as dogs, have no collarbones. Those that hang from trees, such as apes, have large collarbones. Marshall R. Urist

See also Human Body (Trans-Vision picture).

COLLARDS, *KAHL uhrdz*, are the leaves of the collard plant, a vegetable related to the cabbage. The collard resembles kale, and can grow in warmer climates than ordinary kale (see Kale). It is usually grown in the southern United States. The collard plant may grow to a height of 2 to 4 feet (61 to 120 centimeters). In warm climates, the seeds may be planted in September and the leaves picked the following spring and summer. Seeds may also be planted in summer and the leaves picked the following winter. Collards are cooked and eaten. They provide a rich source of vitamin A.

Scientific Classification. The collard plant belongs to the mustard family, *Cruciferae*. It is classified as genus *Brassica*, species *oleracea*, variety *acephala*. John H. MacGillivray

COLLATERAL. See BANKS AND BANKING (Terms).

COLLECTING is a popular kind of hobby. A person can choose to collect almost any type of article. Popular objects for collections include autographs, dolls, coins, stamps, and matchbook covers. See also HOBBY with its list of *Related Articles*.

COLLECTION AGENCY is an organization that collects the payment of past-due bills. Many physicians, dentists, hospitals, stores, and manufacturers hire a collection agency instead of spending their own time trying to collect such debts. The agency receives a fee ranging from a fourth to half of the amount it collects. There are more than 5,000 collection agencies in the United States. They try to collect a total of from $2 to $3 billion in overdue accounts annually.

A collection agency deals with a debtor chiefly through letters and telephone calls. At first, the agency may merely urge the debtor to pay his bill so that his credit rating does not suffer. Each successive letter or call becomes firmer in its demand for payment.

If the debtor does not pay, the agency may take legal action against him. For example, it may obtain a court order that requires the debtor's employer to pay the agency part of his wages. But in many cases, the agency tells the *creditor* (the person to whom the money is owed) that the money cannot be collected. The creditor then decides what legal action to take, if any. The threat of such action persuades many debtors to settle their accounts. About 30 states license collection agencies, but only a few states regulate collecting practices. JAMES B. LUDTKE

COLLECTIVE BARGAINING. See LABOR (Collective Bargaining); STRIKE (Functions).

COLLECTIVE FARM is a government-owned and government-planned farm in Communist countries. The government organizes collective farms to try to increase production and maintain control over the farmworkers.

The land and most of the farm equipment belong to the government. The people who work on the farm must pay rent to the government out of the sale of the farm's products. The government determines the variety and quantity of crops to be grown in an area, and each farm has a committee which decides how to meet these goals. A typical collective farm may cover 1,200 acres (490 hectares) and be farmed by 80 families. Every farm has a village where each family owns a small cottage, the plot surrounding it, and some livestock. Collective farming began in Russia in the late 1920's. See also the Agriculture sections of the articles on POLAND; ROMANIA; RUSSIA; YUGOSLAVIA; and the Economy section of the article on BULGARIA.

COLLECTIVE OWNERSHIP. See SOCIALISM.

COLLECTIVE SECURITY. See INTERNATIONAL RELATIONS.

COLLEGE. See JUNIOR COLLEGE; UNIVERSITIES AND COLLEGES.

COLLEGE BOARDS. See COLLEGE ENTRANCE EXAMINATION.

COLLEGE DEGREE. See DEGREE, COLLEGE.

COLLEGE ENTRANCE EXAMINATION is a test or series of tests that help determine whether or not a person meets the admission requirements of a university or college. Entrance examinations are also useful for placement and guidance. Universities and colleges that use entrance examinations also have other standards for admission. These include satisfactory high school grades and recommendations from teachers, principals, and other persons.

Some universities and colleges give their own entrance examinations. Others require students to take either the *College Boards*, prepared by the College Entrance Examination Board, or the *ACT battery*, prepared by the American College Testing Program, Inc.

Kinds of College Boards. The College Entrance Examination Board gives two kinds of admissions tests—the Scholastic Aptitude Test (SAT) and the Achievement Tests. The *Scholastic Aptitude Test* is designed to test a student's ability to reason. The *Achievement Tests* are designed to test a student's achievement in such fields as mathematics, languages, and social studies. The College Board also gives a preliminary SAT to high-school juniors to help guide and prepare them for admission into college.

All schools that use the College Boards require the Scholastic Aptitude Test. However, not all schools insist on the Achievement Tests. Schools that do require both tests usually ask prospective students to take three Achievement Tests in addition to the SAT.

The Scholastic Aptitude Test is a three-hour examination. The test consists of multiple-choice questions divided into two main groups—verbal and mathematics. Students may also be required to write an essay, called the *Writing Sample*. The Board does not grade the essay, but sends copies to universities and colleges that request an example of the student's writing ability.

The *verbal* sections place stress on the ability to read with understanding and the ability to understand word relationships. Following are two examples of the many kinds of questions asked in the verbal sections.

Directions: Each question below consists of a word printed in capital letters, followed by five words lettered A through E. Choose the lettered word which is most nearly *opposite* in meaning to the word in capital letters.

1. UNFIT: (A) tight (B) qualified (C) chosen (D) serene (E) necessary
2. TANGIBLE: (A) radial (B) immaterial (C) minute (D) diffuse (E) unproved

The *mathematics* sections stress the ability to understand concepts and solve problems. Here are two samples of the mathematics problems.

Directions: In this section solve each problem, using the blank space at the right of the page for figuring. (In the actual test, ample space for computation will be allowed in the test book and no other paper will be allowed.) Then indicate the *one* correct answer in the appropriate space on the answer sheet.

1. In North Dakota the temperature has gone as high as 114° and as low as −45°. How many degrees difference is there between these two temperatures? (A) 69 (B) 79 (C) 114 (D) 159 (E) 169
2. A school has 2, 3, or 4 classes each semester in physics, with 20 to 30 students in each class. If 10% of the physics students failed in one semester, what is the greatest number who could have failed? (A) 3 (B) 6 (C) 8 (D) 10 (E) 12

The Achievement Tests are one-hour examinations in fourteen subject areas ranging from physics and mathematics to history and foreign languages. The achieve-

ment tests also use multiple-choice questions. These tests are designed to measure a student's knowledge of factual information in a specific subject. They also test his ability to reason with this information in order to solve problems relating to the subject.

The ACT Battery has two parts. The major part consists of four tests, covering (1) English, (2) mathematics, (3) natural sciences, and (4) social studies. The second part of the ACT battery is the Student Profile. The profile is a series of questions about the achievements, goals, and special interests of a student. The ACT battery is used for selection, placement, educational guidance, and scholarship awards. Emphasis is placed on intellectual skills, expression, and reasoning, rather than on detailed information.

Administration and Grading. Both the College Boards and the ACT battery are given five times yearly at several testing centers. Scores are sent to the university or college to which the student is applying and to the student's high school. There are no uniform "passing" or "failing" scores on entrance examinations. A score that disqualifies a person for one college may be high enough for admission to another.

Information on the entrance examinations required by a university or college should be obtained from that school. Information on the College Boards can be obtained from the College Entrance Examination Board, c/o Educational Testing Service, Box 592, Princeton, N.J. 08540; or Box 1025, Berkeley, Calif. 94704. Information on the ACT battery is available from the American College Testing Program, Box 168, Iowa City, Iowa 52240. CHARLES O. NEIDT

COLLEGE OF CARDINALS. See SACRED COLLEGE.

COLLEGES, ASSOCIATION OF AMERICAN, is a national organization established in the United States to promote higher education in all its forms in liberal arts colleges. It was founded in 1915. Headquarters are at 1818 R Street NW, Washington, D.C. 20009.

Critically reviewed by ASSOCIATION OF AMERICAN COLLEGES

COLLEMBOLA is an order of small insects. Most insects of this order move about by springing on a flexible tube that grows under their abdomen. For this reason, they are called *springtails*. The adult insects often gather in great numbers on the surface of snow and are sometimes called *snow fleas*. Most collembola eat decaying plants. But some kinds, called *garden fleas*, damage young garden plants. See also INSECT (table).

COLLIE is a dog first bred in Scotland to take care of sheep. It is one of the most intelligent and handsome of dogs. Its long hair grows thick on top, and soft and furry underneath. Its colors are brown and white, black, white and tan, gray, and all white. The collie has a long, narrow head and ears that stand up straight but droop at the points. Its bushy tail curls up at the tip. The dog is medium large. It is about 22 to 26 inches (56 to 66 centimeters) high at the shoulder, and weighs 50 to 75 pounds (23 to 34 kilograms). Some have smooth, short coats.

Collies make excellent pets and companions, and are especially useful for protecting and herding livestock on farms. Such collies as "Lassie" have become famous in motion pictures and television. OLGA DAKAN

See also DOG (picture: Working Dogs); SHEEP DOG.

COLLIMATOR. See SPECTROSCOPE.

COLLINS, MICHAEL (1930-), was a crewman on the Apollo 11 mission, which made the first manned landing on the moon. Collins piloted the command module, *Columbia*, as it orbited above the moon. His fellow astronauts, Neil A. Armstrong and Edwin E. Aldrin, Jr., landed on the moon on July 20, 1969.

Collins was born in Rome, Italy, while his father was stationed there with the U.S. Army. Collins graduated from the U.S. Military Academy in 1952, and became an Air Force officer. He became an astronaut in 1963. Collins was the pilot of the Gemini 10 flight in 1966. In 1970 and 1971, he served as assistant secretary of state for public affairs. He resigned from the astronaut program in 1970. In 1971, Collins became director of the National Air and Space Museum of the Smithsonian Institution. WILLIAM J. CROMIE

COLLINS, WILKIE (1824-1889), an English author, was one of the most successful writers of detective fiction in the 1800's. *The Woman in White* (1860) and *The Moonstone* (1868) rank as Collins' best and most popular novels.

Some critics rank *The Moonstone* among the world's outstanding detective stories. Sergeant Cuff, a character in the novel, was one of the first detectives in English fiction. The book is about a diamond called the moonstone which is stolen from the forehead of an image of the moon-god of India. A curse, and sometimes murder, follows the diamond until it is returned.

William Wilkie Collins was born in London. He became a lawyer in 1851, but never practiced law. However, he used his knowledge of law in writing his books. Collins gained his first literary success with *Antonina* (1850), a historical novel set in ancient Rome. In 1851, he met Charles Dickens and the two became close friends. Collins' first important mystery novel, *The Dead Secret* (1857), appeared in Dickens' magazine *Household Words*. PHILIP DURHAM

COLLIP, JAMES BERTRAM. See BANTING, SIR FREDERICK GRANT.

COLLISION INSURANCE. See INSURANCE (Automobile).

COLLODI, *kuh LOH dih,* **CARLO** (1826-1890), an Italian author, wrote the famous children's story *The Adventures of Pinocchio* (1883). Collodi's real name was Carlo Lorenzini. He took the pen name *Collodi* from the village where he spent much of his youth. Collodi was born in Florence and worked as a journalist for many years. He also wrote humorous fiction for adults and many children's stories.

In Collodi's famous story, Pinocchio is a wooden puppet carved by a kindly old man named Geppetto. The puppet comes to life and has many unhappy adventures because he is lazy and selfish. At the end of the story, Pinocchio has learned to be generous and honest and to work hard. As a reward, a fairy grants his wish and turns him into a real boy. SERGIO PACIFICI

COLLODION, *kuh LOH dee uhn,* is a heavy, colorless, clear liquid. Collodion consists of pyroxylin, or cellulose nitrate, which is dissolved in ether and alcohol. It is used for covering burns and wounds. Painted on the skin, it dries rapidly and forms a thin protective covering. Collodion is also used to make airtight seals, and to make filters in the study of viruses.

COLLODION COTTON. See GUNCOTTON.

COLLOID, *KAHL oyd,* is a preparation composed of tiny particles of one material *dispersed* (evenly distributed) in another material. The particles are either large single molecules or large groups of smaller molecules. At least one dimension of a colloidal particle lies between a few millimicrons and a few thousand millimicrons. One millimicron equals one billionth of a meter, or $\frac{1}{25,400,000}$ of an inch. Colloids are often called *sols*—or *hydrosols* if the particles are dispersed in water.

Many familiar products are colloids or were colloidal during manufacture. These products include ceramics, cosmetics, detergents and soaps, foods, paints, papers, pesticides, and plastics. Protoplasm and most other fluids in living organisms are colloids. The behavior of colloids lies between that of solutions of low molecular weight compounds and coarse suspensions.

Colloids are divided into three main groups: (1) *lyophobic* (solvent-hating), (2) *lyophilic* (solvent-loving), and (3) association colloids.

In lyophobic colloids, the material between the particles has little attraction for them. Therefore, these colloids are not highly *stable* (able to remain dispersed). Some sols owe what stability they have to electric charges on the colloidal particles. Because of their charges, the particles repel one another and thus remain dispersed. The presence of the colloidal particles in sols can be shown by their property of scattering light rays. This scattering is known as the *Tyndall effect* and is used in ultramicroscopes (see ULTRAMICROSCOPE).

In lyophilic colloids, the dispersed material is attracted to the solvent. These colloids are more stable than lyophobic colloids because they are solutions of high molecular weight compounds. Lyophilic sols are found in animal and plant fluids.

The molecules of association colloids have a hydrocarbon chain with a *hydrophilic* (water-loving) "head" group and a *hydrophobic* (water-hating) "tail" group. When dissolved in water, the molecules form clusters called *micelles.* The micelles keep the head groups in contact with water and also protect the tails from water within the micelle. The interior of the micelles dissolves oily material and keeps it in stable suspension. Detergents and soaps are common examples of association colloids. E. D. GODDARD

COLLOQUIALISM. See LANGUAGE (table: Terms).

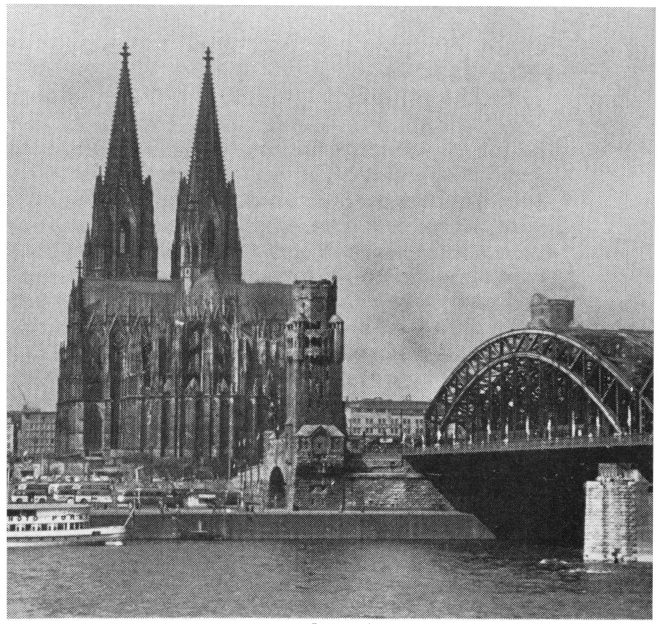
COLLOTYPE PRINTING. See PRINTING (Other Printing Processes).

COLLUSION is a secret arrangement between two or more persons to obtain something illegally. They may make an agreement to defraud, or cheat, a third person, or to obtain something to which they are not legally entitled from a court.

For example, a husband and wife may use collusion in obtaining a divorce. If the wife makes a false charge of cruelty and the husband falsely admits it, then they are both guilty of collusion. Usually collusion is not considered a crime in itself, but it may form the basis for some other offense. For example, it might form the basis for a perjury offense (see PERJURY). FRED E. INBAU

COLOGNE, a toilet water. See COLOGNE; PERFUME.

COLOGNE (pop. 866,300) is a Rhine River port and industrial and trade center in western West Germany. For location, see GERMANY (political map). Its German name is KÖLN. Cologne became important early in the Middle Ages, when most people traveling north from Italy followed the Rhine route. Since the early 1800's, Cologne has been an important market place for western Germany. It is also an important governmental administrative center.



German Tourist Information Office

The Spires of the Magnificent Cologne Cathedral stand about 525 feet (160 meters) high. The Cathedral Bridge, *right,* crosses the Rhine River and leads to the Cologne suburb of Deutz.

Cologne lies in a half-circle on the curving west bank of the Rhine. Across the river, Cologne's suburb of Deutz looks back at the ancient city. The old buildings and narrow streets of ancient Cologne formed a center around which the present city grew. Cologne spread so rapidly that in 1885 the old Roman walls were torn down to make space for more housing. A circle of boulevards, called the *Ringstrassen,* replaced the old walls.

Cologne produces textiles, sugar, tobacco, glue, chemical products, railroad cars, and diesel engines. The city's best-known product is a toilet water called *Eau de Cologne,* which has been made there for over 200 years.

In ancient days, the town of Cologne belonged to the Teutonic tribe of Ubii. It became a Roman colony by A.D. 50 and was named Colonia Agrippina, after the wife of the Roman emperor Claudius (see AGRIPPINA THE YOUNGER). Its name was changed to Colonia, and later to Cologne and Köln. In the 1200's, Cologne became a free city of the Holy Roman Empire, with rights of self-government. It was one of the most powerful towns in the Hanseatic League (see HANSEATIC LEAGUE). At the beginning of the 1500's, new trade routes opened and Cologne lost its importance. During the 1800's, it developed into a manufacturing and shipping center. Construction of the Cologne Cathedral started during the 1200's, but the building was not completed until 1880.

During World War II, Allied bombers destroyed much of Cologne. The famous Cathedral was damaged, but escaped destruction. For several years after the war ended in 1945, the city was under British occupation. In 1949, Konrad Adenauer, a former mayor of Cologne (1917-1933), became chancellor of West Germany (see ADENAUER, KONRAD). JAMES K. POLLOCK

See also GOTHIC ART (picture); RHINE RIVER.

Tom Hollyman, Photo Researchers

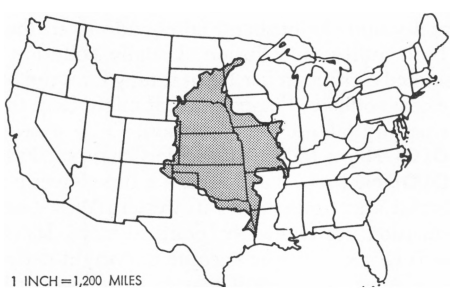
Cartagena, Colombia, once a major Spanish stronghold, lies on the Caribbean Sea. Old fortresses, churches, and walled parts of the city show the influence of Spanish occupation.

COLOMBIA, *kuh LUHM bee uh,* lies in the northwestern corner of South America. Its cool mountains and valleys have fertile soils and precious minerals. Vast pastures, thick forests, and tropical crops cover the hot, low plains. Colombia's natural wealth has attracted men since the days when explorers first touched the American continent. At that time, they searched for the fabled treasures of El Dorado, the Indian chieftain who clothed himself in powdered gold. The searching parties started from the Caribbean seaport of Santa Marta, which was established in 1525 and is the oldest permanent settlement in South America. Today, the nation's wealth comes from such products as coffee and oil. Bogotá is the capital and largest city of Colombia.

The country was named for Christopher Columbus, although in 1499 the Spanish explorer Alonso de Ojeda became the first European to reach it. Columbus came near Colombia in 1502, when he sailed along the Panama coast on his last voyage to America. The name of the country in Spanish, the official lan-

WORLD BOOK map

Colombia lies in northwestern South America. It covers about one-seventh the area of the United States, not counting Alaska and Hawaii.



FACTS IN BRIEF

Capital: Bogotá.

Official Language: Spanish.

Form of Government: Republic.

Head of State: President.

Political Divisions: 22 departments, 3 intendancies, 5 commissaries, and 1 special district.

Area: 439,737 sq. mi. (1,138,914 km²). *Greatest Distances*—northwest-southeast, 1,170 mi. (1,883 km); northeast-southwest, 850 mi. (1,368 km). *Coastline*—580 mi. (933 km) along the Pacific Ocean; 710 mi. (1,143 km) along the Caribbean Sea.

Elevation: *Highest*—Cristóbal Colón, 18,947 ft. (5,775 m) above sea level. *Lowest*—sea level, along the coast.

Population: *Estimated 1976 Population*—25,511,000; distribution, 65 per cent urban, 35 per cent rural; density, 57 persons per sq. mi. (22 persons per km²). *1964 Census*—17,484,508. *Estimated 1981 Population*—29,862,000.

Chief Products: *Agriculture*—bananas, cacao, coffee, corn, manioc, potatoes, rice, sugar cane, wheat. *Mining*—coal, emeralds, gold, petroleum, platinum, salt, silver. *Manufacturing*—beverages, cement, chemicals, leather, steel, sugar, textiles, tobacco.

Flag: The flag has a yellow horizontal stripe above narrower blue and red stripes. Yellow is for independence, wealth, and justice; blue for loyalty, vigilance, and nobility; red for courage, honor, and generosity. See FLAG (picture: Flags of the Americas).

National Holiday: Independence Day, July 20.

National Anthem: "El Himno Nacional."

Money: *Basic Unit*—peso. See MONEY (table: Values).

guage, is REPÚBLICA DE COLOMBIA (REPUBLIC OF COLOMBIA).

For the relationship of Colombia to other American nations, see LATIN AMERICA; ORGANIZATION OF AMERICAN STATES; PAN AMERICAN UNION.

The Land and Its Resources

Location and Size. Colombia is the only South American country that faces both the Caribbean Sea and the Pacific Ocean. The Caribbean borders Colombia to the north for 710 miles (1,143 kilometers). The Pacific borders it on the west for 580 miles (933 kilometers). The *Color Map* shows that Venezuela borders Colombia on the northeast. Brazil borders the southeast. Peru and Ecuador lie to the south. Panama forms part of the northwest border. Three islands in the Pacific and five in the Caribbean are part of Colombia. Colombia is the fourth largest country in South America.

Land Regions include mountains, coastal lowlands, and interior plains.

Mountains. The Andes Mountains enter Colombia at the country's southwest edge and fan into three distinct ranges. These ranges run through Colombia from southwest to northeast, in the same general direction as the coastline. The westernmost range is the Cordillera Occidental; the middle one, the Cordillera Central; and the eastern, or inland, range is the Cordillera Oriental. The Sierra Nevada de Santa Marta, a range separate from the Andes, rises in northeastern Colombia. There, snow-covered Cristóbal Colón, the country's highest peak, towers 18,947 feet (5,775 meters) above sea level.

Coastal Lowlands extend along the shores of the Pacific Ocean and Caribbean Sea. The Pacific lowlands consist mostly of swamps and jungles. Few people live in this area. The Caribbean lowlands are fertile. Farmers there cultivate many tropical crops, and large herds of cattle graze in the grassy areas.

Interior Plains. The eastern three-fifths of Colombia is a vast plain, almost at sea level. Jungle covers the southern part. There, half-civilized Indians live in isolated villages. The northern part of the great plain is called the *llanos*, and is covered by grass and scattered trees. See LLANOS.

Rivers. The Magdalena, Colombia's chief river, rises at a junction of the Cordilleras Central and Oriental. It flows northward to the Caribbean. River freighters and passenger ships can sail up about 700 miles (1,100 kilometers) of its 950-mile (1,530-kilometer) winding course. Other navigable rivers include the Atrato, Caquetá, Cauca, and Meta.

Natural Resources. Pools of petroleum lie underground in northern Colombia, near Barrancabermeja. Antioquia Department has gold and silver reserves. The only platinum mined in South America comes mainly from Chocó Department. Mines near the cities of Muzo and Chivor yield emeralds. Coal, iron ore, and limestone occur throughout several departments.

Climate in Colombia depends largely on altitude, and varies from extreme tropical heat to damp, biting cold. The Pacific lowlands are hot and muggy, and the Caribbean lowlands have hot but drier weather.

As the land slopes up into the foothills, the temperature stays hot and the rainfall becomes heavy. Low mountain ranges up to 3,000 feet (910 meters) have a year-round temperature of 75° to 80° F. (24° to 27° C). The high plateaus have frequent but light rains. There, the temperature hovers around 60° F. (16° C).

Average January temperatures range from 58° F. (14° C) in Bogotá to about 82° F. (28° C) at Barranquilla. July temperatures average from about 57° F. (14° C) at Bogotá to 84° F. (29° C) at Barranquilla.

The jungle forests have heavy rains throughout the year. Colombia's swampy Pacific coast is the rainiest

Robert C. West, the contributor of this article, is Professor of Geography and Anthropology at Louisiana State University. He wrote Pacific Lowlands of Colombia.

Goajiro Indian Women sew up large sacks of pure salt gathered on the northern coast of Colombia. Once each year, thousands of Indian families come to the coast to harvest tons of salt that have been evaporating for 10 months under the hot tropical sun.

Hamilton Wright

place in all the Americas. Each year, a small area along the Atrato River receives more than 350 inches (889 centimeters) of rain.

Life of the People

The People. Most of the people live in the green valleys and basins of western Colombia. This area makes up about two-fifths of the land. The vast eastern plains of Colombia average about one person per square mile (0.39 person per square kilometer).

About 40 of every 100 Colombians are *mestizos* (persons of mixed white and Indian descent). About 30 of every 100 are whites, mostly of Spanish descent; about 15, mulattoes; 7, Indians; and 5, Negroes. Most Colombians belong to the Roman Catholic Church.

Cities. The leading cities of Colombia were among the first in the Western Hemisphere to be settled. Today, these cities have modern buildings and roads, as well as narrow, cobblestoned streets lined by old houses. Many of them have carved doorways and brown-tiled roofs.

Bogotá, the capital and largest city, is a center of art and learning, and also has many factories. High in the Andes Mountains, northwest of Bogotá, lies Medellín, the second largest city.

Buenaventura, Colombia's leading port, is on a small island in a bay on the Pacific coast. Three-fourths of the country's coffee exports pass through this port. The ancient walled city of Cartagena, founded by the Spaniards in 1533, also lies on an island, in the Caribbean Sea. The industrial port city of Barranquilla lies on the Caribbean coast. See the separate articles on the cities listed in the *Related Articles* section of this article.

Work of the People

Agriculture is the chief industry in Colombia. But only about 4 per cent of the land is cultivated, and the average farm covers only 5 acres (2 hectares). The average coffee plantation has only about 3,000 trees.

Indian farmers use primitive methods to grow scanty crops of corn, beans, and manioc, from which a bread

COLOMBIA MAP INDEX

Departments*

ANTIOQUIA	3,031,000	B 1
ATLÁNTICO	903,000	A 1
BOLÍVAR	849,000	B 2
BOYACÁ	1,914,000	B 2
CALDAS	811,000	B 1
CAUCA	696,000	C 1
CÉSAR	357,000	A 2
CHOCÓ	210,000	C 1
CÓRDOBA	760,000	B 1
CUNDINAMARCA	3,727,000	B 2
HUILA	485,000	C 1
LA GUAJIRA	173,000	A 2
MAGDALENA	683,000	A 2
META	248,000	C 2
NARIÑO	787,000	C 1
NORTE DE SANTANDER	615,000	B 2
QUINDÍO	346,000	C 1
RISARALDA	512,000	B 1
SANTANDER	1,137,000	B 2
SUCRE	361,000	B 1
TOLIMA	902,000	C 1
VALLE DEL CAUCA	2,114,000	C 1

Intendancies*

ARAUCA	32,000	B 2
CAQUETÁ	157,000	C 2
SAN ANDRÉS Y PROVIDENCIA	27,000	†

Commissaries*

AMAZONAS	16,000	D 2
GUAINÍA	5,000	C 3
PUTUMAYO	77,000	C 1
VAUPÉS	18,000	C 2
VICHADA	9,000	C 3

Cities and Towns

Abejorral*	6,874	B 1
Aguachica	8,556	B 2
Aguadas	10,822	B 1
Agua de Dios*	7,401	C 2
Andes	11,135	B 1
Anserma	14,129	B 1
Arjona	16,510	A 1
Armenia	187,941	C 1
Armero	17,495	C 2
Banco, see El Banco		
Baranoa	14,064	A 2
Barrancabermeja	59,625	B 2
Barranquilla	648,173	A 2
Bello	85,894	B 1
Bogotá	2,680,100 *2,818,300	C 2
Bolívar	9,532	B 1
Bucaramanga	318,267	B 2
Buenaventura	70,079	C 1
Buga	65,535	C 1
Caicedonia	16,327	C 1
Calarcá	30,342	C 1
Caldas*	17,704	B 1
Cali	921,690	C 1
Campoalegre	9,768	C 1
Campo de la Cruz	10,044	A 2
Cartagena	322,530	A 1
Cartago	55,682	C 1
Cereté	11,849	B 1
Chaparral	13,261	C 1
Chinchiná*	15,944	C 1
Chinú	7,552	B 1
Chiquinquirá	16,926	B 2
Ciénaga	47,719	A 2
Ciénaga de Oro	8,047	B 1
Cisneros*	7,554	B 1
Codazzi	11,673	A 2
Convención	7,371	B 2
Copacabana	9,665	B 1
Corozal	14,000	B 1
Cúcuta	240,595	B 2
Duitama	31,865	B 2
El Banco	14,889	B 2
El Carmen	19,196	B 1
El Cerrito*	12,200	C 1
Envigado	40,686	B 1
Espinal	22,791	C 2
Facatativá	20,742	C 2
Flandes	12,015	C 2
Florencia	17,709	C 1
Florida*	12,875	C 1
Fredonia*	7,795	B 1
Fresno*	7,058	C 1
Fundación	14,128	A 2
Fusagasugá	18,755	C 2
Garzón	11,999	C 1
Girardot	66,584	C 2
Guamo	8,350	C 1
Honda	19,945	B 2
Ibagué	206,022	C 1
Iplales	23,320	C 1
Itagüí	60,318	B 1
Jericó	8,071	B 1
La Ceja	9,424	B 1
La Dorada	26,168	B 2
La Tebaida*	10,020	C 1
La Unión	8,223	C 1
La Victoria*	7,236	C 1
La Virginia*	12,223	C 1
Leticia	4,013	D 3
Líbano	18,640	C 1
Lorica	12,880	B 1
Madrid	6,938	C 2
Magangué	27,354	B 2
Mahates	8,204	A 1
Maicao	9,347	A 2
Málaga	9,674	B 2
Manizales	286,908	B 1
Marinquita*	9,573	B 2
Medellín	1,096,790	B 1
Mitú	1,623	C 2
Mocoa	2,571	C 1
Mompós	10,965	B 2
Montenegro*	11,350	C 1
Montería	158,202	B 1
Natagaima	8,372	C 1
Neira*	7,672	B 1
Neiva	116,681	C 1
Ocaña	28,028	B 2
Pacho	7,192	B 2
Palmar de Varela*	6,981	A 2
Palmira	106,502	C 1
Pamplona	25,502	B 2
Pasto	131,201	C 1
Pereira	235,468	C 1
Piedecuesta	12,278	B 2
Pitalito	10,818	C 1
Pivijay	8,200	A 2
Plato	13,364	B 2
Popayán	97,714	C 1
Pradera*	11,223	C 1
Puerto Berrío	15,812	B 2
Puerto Boyacá	10,895	B 2
Puerto Carreño	1,115	B 3
Puerto Colombia	7,143	A 2
Puerto Tejada	14,863	C 1
Purificación	7,044	C 2
Quibdó	58,402	B 1
Quimbaya*	11,872	C 1
Riohacha	47,877	A 2
Rionegro	12,541	B 1
Ríosucio	11,274	B 1
Roldanillo*	9,212	C 1
Sabanalarga	20,254	A 2
Sahagún	11,560	B 1
Salamina	14,263	B 1
San Andrés	9,040	†
San Estanislao*	7,118	A 1
San Felipe	187	C 3
San Gil	18,518	B 2
San Jacinto	10,210	B 1
San Juan Nepomuceno	8,873	B 1
San Marcos	7,083	B 1
San Onofre	10,737	B 1
San Vicente de Chucurí	7,873	B 2
Santa Bárbara*	7,779	B 1
Santa Marta	149,755	A 2
Santa Rosa	6,860	B 1
Santa Rosa de Cabal	31,646	C 1
Santander	11,426	C 1
Santo Tomás*	7,505	A 2
Segovia	9,234	B 2
Sevilla	26,757	C 1
Sincé	10,631	B 1
Sincelejo	70,652	B 1
Soacha*	11,435	C 2
Socorro	13,716	B 2
Sogamoso	32,274	B 2
Soledad	37,617	A 2
Sonsón	16,955	B 1
Tolú	7,954	B 1
Toro*	8,812	C 1
Tuluá	56,539	C 1
Tumaco	25,145	C 1
Tunja	84,289	B 2
Túquerres	10,698	C 1
Turbaco	14,255	A 1
Turbo	7,375	B 1
Urrao	7,712	B 1
Valledupar	128,655	A 2
Vélez	7,033	B 2
Venadillo*	6,931	C 2
Villanueva	8,288	A 2
Villavicencio	75,425	C 2
Viterbo*	7,241	B 1
Yarumal	16,823	B 1
Yumbo	15,270	C 1
Zambrano	6,993	B 2
Zapatoca*	7,305	B 2
Zarzal	17,768	C 1
Zipaquirá	22,648	B 2

Physical Features

Andes Mountains		C 1
Apaporis River		C 2
Ariari River		C 2
Atrato River		B 1
Caguán River		C 2
Cahuinari River		D 2
Cape Corrientes		B 1
Caquetá River		D 2
Casanare River		B 2
Cauca River		B 1
Cordillera Central (Mountains)*		C 1
Cordillera Occidental (Mountains)*		C 1
Cordillera Oriental (Mountains)*		C 2
Cristóbal Colón (Peak)		A 2
Guainía River		C 3
Guaviare River		C 2
Guayabero River		C 2
Gulf of Morrosquillo		B 1
Gulf of Urabá		B 1
Igara Paraná River		D 2
Inírida River		C 3
Magdalena River		B 2
Meta River		B 3
Nechí River		B 2
Orinoco River		C 3
Patía River		C 1
Point Charambirá		C 1
Point Cruces		B 1
Point Espada		A 2
Point Gallinas		A 2
Point La Vela		A 2
Point Solano		B 1
Putumayo River		D 2
San Juan River		C 1
Sierra de Perijá (Mountains)		B 2
Sierra Nevada de Santa Marta (Mountains)		A 2
Sinú River		B 1
Tolima (Mountain)		C 1
Tomo River		B 3
Upía River		C 2
Vaupés River		C 2
Vichada River		C 3
Yarí River		C 2

*Does not appear on map; key shows general location.
†Does not appear on map; on island group in Caribbean Sea off coast of Nicaragua.
*Population of metropolitan area, including suburbs.

Sources: Official estimates (1972) for Bogotá and (1970) for departments and capital cities; latest census (1964) for other places.

Specially created for **World Book Encyclopedia** by Rand McNally and World Book editors

Big Skyscrapers in Cali, Colombia, tower above low, Spanish-style homes with their colorful tile roofs. The city is the main commercial center of the fertile Cauca Valley.

Hamilton Wright

is made. Planters use the latest scientific methods to grow coffee, bananas, rice, and sugar cane. Only Brazil grows more coffee than Colombia. Colombia also ranks high in the production of bananas and cacao beans. Other crops include cotton, fruits, potatoes, tobacco, and wheat. Cattle graze on grass in fertile valley bottoms, on mountain slopes, and on the plains.

Mining. Colombia ranks as one of the leading South American oil-producing countries. Drillers tap most of the oil from three fields—two near the Magdalena River at Barrancabermeja, and one at Catatumbo.

Colombia mines and dredges more gold than any other South American country. Miners take most of the gold from about 630 mines in Antioquia Department. Silver usually occurs with the gold. The area around the Atrato and San Juan rivers in Chocó Department yields platinum. Colombia is the only South American country with platinum deposits. Most of the world's emeralds are mined at Muzo and Chivor. Several departments mine coal, iron, and limestone. A soda plant operates near salt mines at Zipaquirá.

Manufacturing and Processing are not highly developed in Colombia, but they are growing steadily. The country has over 47,000 small manufacturing plants. Cotton and wool textiles are the most important manufactures. The first steel mill in Colombia opened in 1954 in Paz de Río in Boyacá Department. Other factories make processed foods, beverages, shoes, and chemicals.

Forest Industry. Trees cover almost 150 million acres (61 million hectares). Valuable timber includes mahogany, dyewoods, cedar, and laurel. Cinchona tree bark yields quinine.

Transportation. About 2,000 miles (3,200 kilometers) of narrow-gauge railways and 12,500 miles (20,120 kilometers) of roads crisscross Colombia. Mountains have made road and railroad construction difficult. Landslides often destroy roadbeds during rainy periods. In 1961, Colombia completed a 418-mile (673-kilometer) rail line, linking Bogotá and Santa Marta. It took nine years to lay the track through swampy rain forests.

Most of Colombia's markets are served by rail or road from the Magdalena River, the most important route for commerce since the early 1500's. This river still carries about 95 per cent of all the river traffic. Chief seaports include Buenaventura and Tumaco on the Pacific Ocean, and Barranquilla, Cartagena, and Santa Marta on the Caribbean Sea.

Communication. Twenty-two daily newspapers are published in Colombia. Bogotá's morning *El Tiempo* has the largest circulation. Colombia has two television stations and about 200 radio stations. The government operates postal, telephone, and telegraph services that reach even the most remote areas.

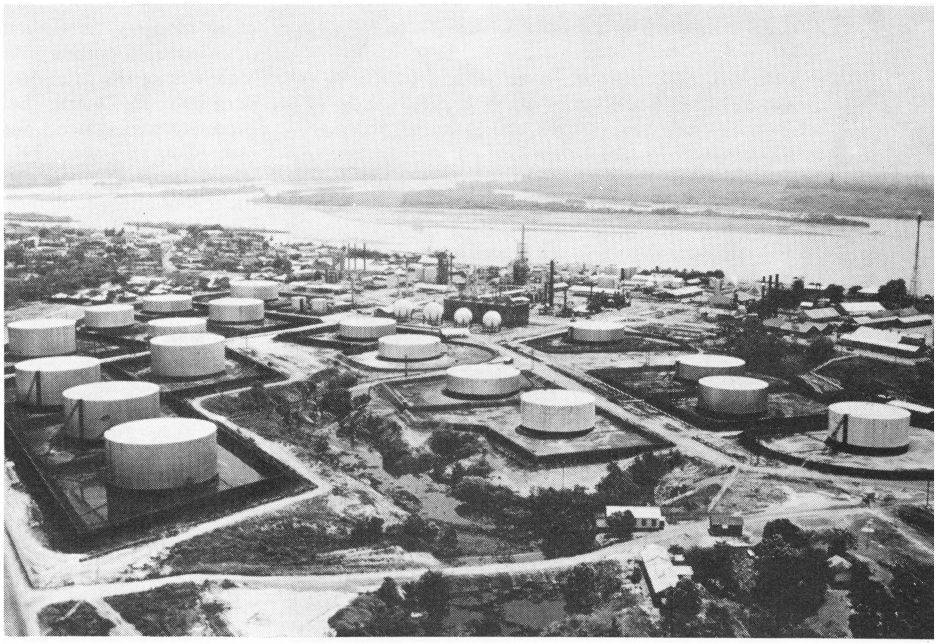
Education

Primary education in Colombia is free. A 1956 law requires every child over 7 to go to school for at least five years. More than 1,500,000 students attend elementary, high, commercial, and teacher-training schools, and other educational institutions. Teachers travel to isolated regions to teach children who cannot be reached in any other way. In 1947, Father José Salcedo, a Roman Catholic priest, founded a *radio school* in Sutatenza. About 250,000 farm families have learned to read and write by listening to his educational program.

The country has more than 50 institutions of higher learning. The National University at Bogotá, founded in 1572, is the oldest university in the country.

The Arts

Long before the arrival of the white man, the Indians showed a high degree of artistic ability. They used gold and silver in jewelry and in the decoration of



Huge Oil Refineries line the Magdalena River in Barrancabermeja, a major petroleum drilling and refining center in the interior of Colombia. A pipeline carries oil to Cartagena on the Caribbean coast.

General Secretariat, OAS

masks, ceremonial bowls, and goblets. Ancient ruins in Colombia reveal beautifully carved stone objects. The conquering Spaniards used these skills in decoration and sculpture, especially in the churches. Modern Colombian art has Indian, Spanish, French, and Mexican influences.

Colombia has made its greatest cultural contributions through its poets, novelists, and journalists. Most of its presidents have been men of literary and journalistic fame. Probably the best-known Colombian writer is Jorge Isaacs, whose most important novel, *María*, was published in 1867.

Government

Colombia became a republic under the constitution of 1886, which was revised in 1910, 1936, and 1945. The national government resembles that of the United States.

The people of Colombia elect the president to a four-year term. Every citizen over 21 may vote. The president may serve more than one term, but not consecutively. He appoints 13 ministers to his Cabinet. The people also elect the Congress, consisting of an 80-member Senate, and a House of Representatives of 152 members. Senators serve four-year terms, and representatives hold office for two years. The largest political parties in Colombia are the Conservative Party and the Liberal Party.

Congress elects the vice-president for four years by a majority vote of both houses. A Supreme Court of 20 justices heads the nation's court system. Colombia is divided into 22 departments, 3 intendancies, 5 commissaries, and 1 special district. Each department has an elected assembly and a governor appointed by the president. The president appoints heads of intendancies and commissaries.

Colombia has an army of from 12,000 to 15,000 men, and a navy of about 6,000. A battalion of marines and a small air force also serve the country.

History

Early Days. The Chibcha Indians lived in Colombia before the coming of the white man. They farmed and made pottery. The Chibcha were easily overpowered by Spaniards who explored and settled the country.

The Spanish explorer Alonso de Ojeda reached Colombia in 1499. The Spaniards named it New Granada, after the home province of Gonzalo Jiménez de Quesada, a Spanish lawyer who defeated the Indians and claimed the country for Spain in 1536. Spain established New Granada as a presidency under the viceroy (governor) of Peru in 1564. In 1740, Spain created the Viceroyalty of New Granada, including present-day Colombia, Venezuela, Ecuador, and Panama.

The New Republic. The people of New Granada made the first move to break free of Spain when new taxation caused an Indian uprising in 1781. Spanish troops quickly put down the rebellion. The New Granada patriot Antonio Nariño and others also rebelled against the harsh rule imposed by Spain. Nariño helped fan the flame of independence when he published a translation of the French book *The Rights of Man* in 1794.

In 1796, the viceroyalty was shaken by a revolt in Venezuela. Uprisings followed throughout New Granada. The Venezuelan patriot Simón Bolívar led the forces that finally overthrew the Spanish government in South America in 1819. That same year, Bolívar set up the Republic of Great Colombia. Panama voluntarily joined the republic in 1821, and Ecuador in 1822. General William Henry Harrison, who later became President of the United States, served as minister to Colombia from 1828 to 1829.

Political Revolts broke out in the new republic, and Venezuela and Ecuador established separate govern-

Hamilton Wright

Bunches of Colombian Bananas are washed by plantation workers before they are shipped to markets around the world.

ments in 1830. The Republic of Great Colombia then reorganized as the Republic of New Granada, but suffered civil war and confusion until 1886. The constitution of 1863 restored the name Colombia to the country. The 1886 constitution took most of the power from the states and gave it to the central government.

The 1900's. Panama broke away from the Republic of Colombia in 1903. Colombia's failure to ratify the Hay-Herrán Treaty with the United States was the chief reason for the revolt. This treaty granted the right of way for a ship canal through the Isthmus of Panama. In 1921, the U.S. Senate approved a bill settling the dispute, and granted $25 million to Colombia.

During World War II, the United States used Colombian sea and air bases. Colombia broke off diplomatic relations with the Axis powers in 1941. In 1943, it declared war against Germany. Colombia became a charter member of the United Nations in 1945.

The ninth Pan-American Conference, which met at Bogotá in 1948, was disturbed by a four-day revolution. Communists were blamed for inciting the riots, which began on April 9. In May, Colombia broke off diplomatic relations with Russia.

Recent Developments. Colombia strengthened its industries during the 1950's with funds from the World Bank and technical aid from the United States. In 1957, Gustavo Rojas Pinilla, who had seized the government and became president in 1953, was ousted in a short revolution. A group of military officers assumed control of the government. Alberto Lleras Camargo, candidate of the Conservative-Liberal coalition, was elected president in 1958, ending military control. Guillermo Leon Valencia of the Conservative Party was elected president in 1962. During the 1960's, Colombia's industrial production declined, and unemployment and prices rose. Riots and strikes broke out, and many persons criticized Leon Valencia's government for failing to ease the economic problems. In 1966, the voters elected Carlos Lleras Restrepo, a Liberal, as president. Misael Pastrana Borrero, also a Liberal, was elected president in 1970. He was succeeded by another Liberal, Alfonso Lopez Michelsen, in 1974.

ROBERT C. WEST

Related Articles in WORLD BOOK include:

CITIES

Barranquilla, Buenaventura, Cartagena, Santa Marta, Bogotá, Cali, Medellín

OTHER RELATED ARTICLES

Andes Mountains, Bolívar, Simón, Chibcha Indians, Clothing (picture), Coffee, Emerald, Magdalena River, Pan-American Conferences, Panama (History), Panama Canal, Platinum, Santander, Francisco de P., South America, Venezuela (History)

Outline

I. The Land and Its Resources
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- C. Manufacturing and Processing
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- E. Transportation
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V. The Arts

VI. Government

VII. History

Questions

What is unusual about Colombia's coastline?
What precious metal is found in Colombia that has not been discovered in any other South American country?
Where do most Colombians live? Why?
What is Colombia's chief industry?
Who were Jorge Isaacs? Simón Bolívar? José Salcedo?
What product makes up most of Colombia's exports?
What is the oldest permanent settlement in South America?
What three countries were once part of Colombia?
What did the Spaniards first call Colombia? Why?
What are Colombia's cultural contributions?

COLOMBO, *koh LUM boh* (pop. 562,160), is the capital, seaport, and largest city of Sri Lanka. It lies on the west coast (see SRI LANKA [map]). Most of the island's shipping passes through its fine harbor. Colombo is the center of Sri Lanka's tea, coconut, and cotton trade. It has been a major Asian port for many years.

Colombo is an old city, founded before the mid-1300's. Scholars believe the city was originally known as *Kolamba*, a native term meaning both *port* and *leafy mango tree*. The name *Colombo* is the European version of this term. The Portuguese, who came in 1505, were the first Europeans to control Colombo. The Dutch occupied the city from 1656 to 1796, and erected a number of buildings that still stand. Perhaps the most impressive is the Wolfendhal Church, built in 1749. Colombo is also the home of the University of Sri Lanka.

Camera Press, Pix

An Old Clock Tower in the Heart of Colombo's business district once served as a lighthouse for the city's harbor. The Portuguese built a fort on this site more than 400 years ago.

According to tradition, Buddha visited the temple of Kalaniya just outside Colombo. Commonwealth of Nations leaders set up the Colombo Plan there in 1950. ROBERT I. CRANE

COLOMBO PLAN provides assistance for economic development to countries of South and Southeast Asia. The assistance includes training personnel, scientific research in agriculture and industry, consultative services, and financial aid.

The Consultative Committee, which directs the program, has headquarters in Colombo, Sri Lanka. It consists of representatives from the 24 member countries: Afghanistan, Australia, Bhutan, Burma, Cambodia, Canada, Great Britain, India, Indonesia, Iran, Japan, Laos, Malaysia, the Maldives, Nepal, New Zealand, Pakistan, the Philippines, Singapore, South Korea, South Vietnam, Sri Lanka, Thailand, and the United States.

Member countries within the region plan their own development programs with the advice of the committee. They pay most of the cost of these programs. Member countries outside the region contribute financial assistance and cooperate in other ways. The Colombo Plan Technical Cooperation Scheme is the chief means for technical cooperation.

Percy Spender, then foreign minister of Australia, proposed the idea of the Colombo Plan at a meeting of the Commonwealth Foreign Ministers at Colombo in January, 1950. The Consultative Committee held its first meeting in May, 1950, and published the principles of the plan in November. The Colombo Plan began operating in July, 1951. NORMAN D. PALMER

See also AUSTRALIA (In the 1950's and 1960's).

COLÓN, *koh LOHN* (pop. 67,641), is the second largest city in Panama. It stands on Manzanillo Island, which is actually a peninsula. Colón overlooks Limón Bay, at the Atlantic end of the Panama Canal. For location, see PANAMA (color map).

Colón has clean, wide streets, spacious residential areas, and busy shopping districts. It ships tropical fruits, hardwood lumber, and other products through the neighboring port of Cristóbal in the Canal Zone.

The Americans who built the Panama Railroad in the mid-1800's founded the city in 1852 and named it Aspinwall, after William H. Aspinwall, a promoter of the railroad. In 1890, the Panamanians changed the name to Colón in honor of Christopher Columbus. (*Colón* is Spanish for *Columbus.*) After the Panama Canal opened in 1914, the city became a leading commercial and tourist center. Today, Colón is an important international free trade zone. JOHN BIESANZ and MAVIS BIESANZ

COLON, *KOH lun,* is a mark of punctuation (:). Its primary function is to separate an introduction from what it introduces: a list, a long quotation, an illustration, or an explanation. A colon is used only when the words preceding it form a complete sentence, as in the second sentence of this article. An exception is that a colon may follow an introductory label, such as *thus.* A colon also ends the formal opening of a business letter, and it may be used after the main headings of an outline. SUMNER IVES

See also PUNCTUATION.

COLON, *KOH lun,* is a part of the large intestine. This muscular tube carries *chyme* (food residue) from the *cecum* (the first part of the large intestine) to the *rectum* (the last part). The colon is divided into four sections. The *ascending colon* extends upward on the right side of the abdominal cavity. It joins the *transverse colon,* which extends across the cavity to the opposite side. This section meets the *descending colon,* which passes down the left side to join the S-shaped *sigmoid colon.* In human beings, the colon is about 5 feet (1.5 meters) long. It removes water and mineral salts from the chyme. Its strong muscles contract and relax to push the residue toward the rectum. Mucus covers the colon's inner surfaces to lubricate them and ease the passage of chyme. WILLIAM V. MAYER

See also HUMAN BODY (Trans-Vision three-dimensional color picture); COLITIS; DYSENTERY; INTESTINE.

COLON is a monetary unit used in two Latin-American countries, Costa Rica and El Salvador. In Costa Rica, it is a copper-nickel coin worth 100 centimos. In El Salvador, it is a paper note equal to 100 centavos. Its name comes from the Spanish name for Christopher Columbus, *Cristóbal Colón.* BURTON H. HOBSON

See also MONEY (table: Values of Monetary Units).

COLÓN, ARCHIPELAGO DE. See GALAPAGOS ISLANDS.

COLONEL. See RANK IN ARMED SERVICES.

COLONIAL ARCHITECTURE usually refers to the style of architecture common in the American colonies until the time of the Revolutionary War. See ARCHITECTURE (The 1700's); COLONIAL LIFE IN AMERICA (The Home; pictures).

COLONIAL DAMES OF AMERICA, NATIONAL SOCIETY OF THE, is a society of women organized in 1891 to create an interest in American colonial history. Membership is by invitation, and is based on descent from some ancestor who came to an American colony before 1750, and who, by distinguished services, contributed to the founding of the nation. The society was organized in Philadelphia. It has about 15,000 members. Headquarters are at 2715 Q Street NW, Washington, D.C. 20007. Critically reviewed by the NATIONAL SOCIETY OF THE COLONIAL DAMES OF AMERICA

COLONIAL LIFE IN AMERICA

Many different kinds of people lived in the 13 English colonies that became the United States. This picture shows just a few of them, including, *left to right*, an Indian, a Pilgrim, a New England farmer, a housewife, a town crier, and a Southern planter and his daughter.

COLONIAL LIFE IN AMERICA. The story of the American colonists is one of the great adventure stories of all time. It is the story of brave men and women who sailed across the Atlantic Ocean from Europe, conquered a wilderness, and founded a new nation. This story of courage and achievement took place in a remarkably short time. The colonial period lasted less than 170 years. It began with the settlement of Jamestown in 1607, and ended with the start of the Revolutionary War in 1775.

Most of the colonists were English. But America also attracted thousands of Dutch, French, Germans, Scotch-Irish, and Swedes. The colonists brought different customs and religious beliefs, but they shared a common goal. All were unhappy with life in the Old World and wanted to make a better life in the New World.

The English were latecomers to the Americas, but they were the first Europeans to live in the New World in large numbers. England hoped to compete with other European powers for the riches of the New World. Spain had already developed a huge colonial empire in Central and South America. France controlled Canada and much of the Mississippi Valley.

The Spanish and French were interested chiefly in returning to Europe with furs, gold, and other riches. They also wanted to convert the Indians to Roman Catholicism. Their early settlements served as outposts for soldiers and traders, or as missions conducted by priests. On the other hand, the English colonies were settled by people from almost every walk of life. These people wanted to establish permanent homes in America.

In making America their homeland, the colonists were sometimes helped by the Indians. But often the Indians fought to keep their land. The colonists, fighting together and working together, overcame the Indians and the wilderness. They produced plenty of food and other vital products on their farms and plantations. They carried on a thriving trade with other countries. They built cabins and mansions, villages and cities. They established churches, schools, and local governments.

The colonists had to work hard, and they suffered many hardships. But during most of the colonial period, they had better living conditions and more freedom than any other people in the world.

This article deals entirely with the 13 original English colonies that became the United States. For the history of each colony, from settlement to statehood, see the separate WORLD BOOK articles on the states, such as GEORGIA (History). See also UNITED STATES, HISTORY OF THE (The Colonial Heritage). For the history of other colonies in the New World, see CANADA, HISTORY OF; LATIN AMERICA (History).

The contributor of this article is Jane Carson, Research Associate at The Colonial Williamsburg Foundation. The paintings and drawings are by H. Charles McBarron, a special consultant to the Smithsonian Institution.

COLONIAL LIFE IN AMERICA / *The Thirteen Colonies*

Between 1607 and 1733, the English established 13 permanent colonies on the Atlantic coast of North America. Most of the early settlements began as business projects, operated by individuals or companies organized by merchants. These men obtained permits from the king to colonize his lands in the New World.

The English colonizers had two main goals: (1) to make profits for themselves, and (2) to use the settlements to expand English trade and industry. They advertised America as a land of opportunity, and persuaded many Europeans to migrate to the colonies. Many merchants provided the settlers with transportation, land, and tools and other supplies.

Why the Colonists Came to America

America gave thousands of Europeans a chance to make a new start. The settlers knew they faced serious dangers and would suffer severe hardships. But they had important reasons for accepting the challenge of taming the wilderness.

Economic Opportunities. The settlers included many who could not find work in their European homelands. Everyone could find work in America. The New World had rich land to farm, and much timber to cut. Its waters and woodlands provided plenty of fish and game. All these were strong attractions for people who could not make a decent living in Europe.

Freedom of Worship. Some of the settlers, beginning with the Pilgrims, came to America chiefly because they were promised freedom of worship. Throughout the colonial period, other groups came to the English colonies to escape persecution because of their religious beliefs. These groups included Puritans, Quakers, Roman Catholics, Huguenots, and Jews.

Land Ownership. Many settlers came to America because they were offered land free or at low cost. In those days, owning land gave a man a feeling of independence, and the promise of a good life for his children. Land ownership made a man a *freeholder*. A freeholder had certain rights in the community, generally including the right to vote.

Land was distributed in various ways in the colonies. Under English law, all the land belonged to the king. The king issued permits, called *charters*, which allowed individuals or companies to colonize a certain area. Then each *proprietor* (individual owner) or company distributed the land to settlers. In the early colonization of Virginia, the company gave each settler 100 acres (40 hectares) of free land to develop. Later, the king took back the company's charter and established direct royal control over the colony. Under royal control, each new settler received some free land, usually 50 acres (20 hectares), and could purchase more for only five shillings per acre (0.4 hectare). Anyone who paid the transportation of a new settler got 50 acres free.

In the New England Colonies, where settlements were called townships, the land was first assigned to each township. The township officials then divided the land among the settlers. Each settler got enough land near the village green for a house, garden, and cow shed. He also had a strip of farmland on the edge of the village, where he raised corn and other crops. A settler had the right to sell his land, or to buy more with the consent of the township officials.

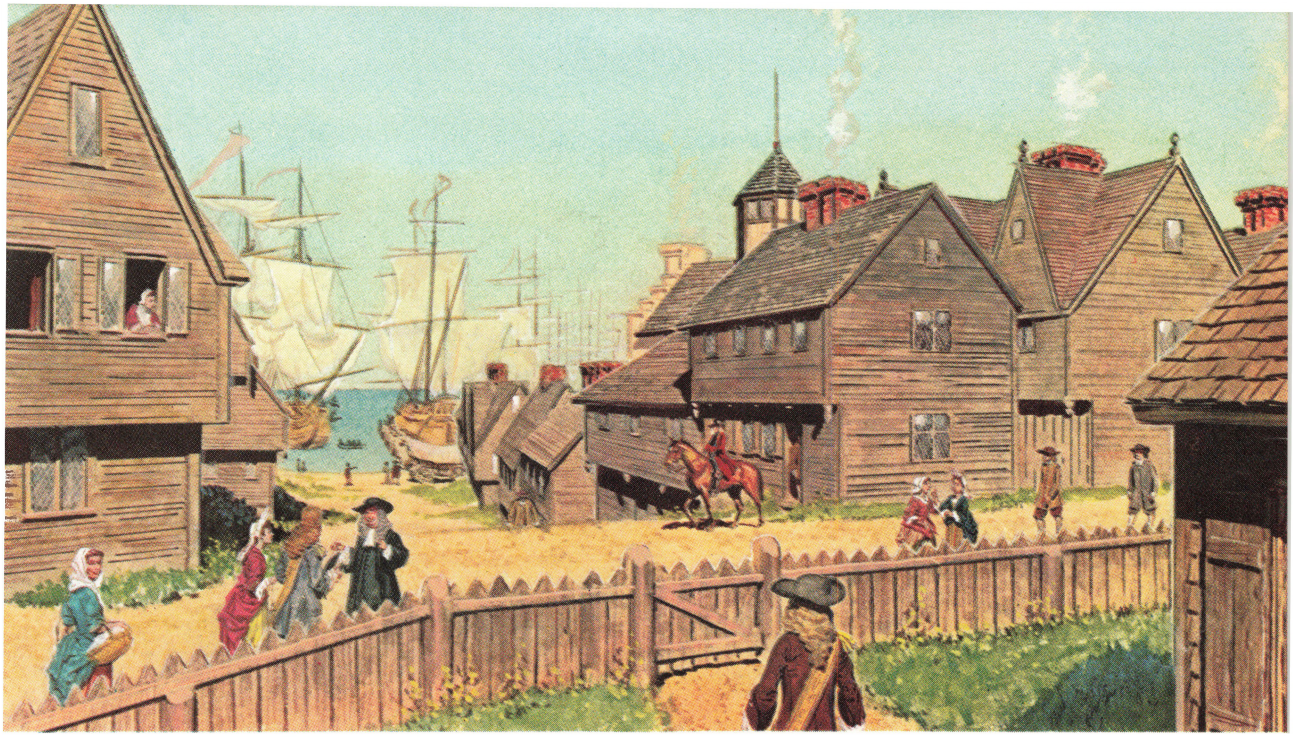
In most of the other colonies, early settlers started as freeholders. Proprietors or companies gave a settler some land, and sold him more at bargain prices. In some colonies, individuals got large tracts of land by promising to develop the property. These promoters then brought

Bettmann Archive

Advertising helped sell shares of the stock companies that developed England's early settlements in the New World.

THE THIRTEEN COLONIES AND THE DATES OF THEIR FIRST PERMANENT SETTLEMENTS

Virginia	1607	**Delaware**	1638
Massachusetts	1620	**Pennsylvania**	1643
New Hampshire	1623	**North Carolina**	c. 1653
New York	1624	**New Jersey**	1660
Connecticut	1633	**South Carolina**	1670
Maryland	1634	**Georgia**	1733
Rhode Island	1636		



NEW ENGLAND VILLAGE

Most New England settlers lived on the Atlantic Coast and earned their living chiefly as fishermen, shipbuilders, or seagoing traders. The rocky soil was not suitable for large farms, but New England had plenty of fine shipbuilding timber, and some of the best fishing waters in the world.

shiploads of settlers to the colony and gave them some land free. After the colony had been developed, the promoters could charge high prices for the remaining land.

Early Settlements

The English made an unsuccessful attempt to establish a colony in North America in 1585. That year, a group sponsored by Sir Walter Raleigh started a settlement on Roanoke Island, off the coast of what is now North Carolina. The settlers soon returned to England, and another group landed in 1587. This group disappeared mysteriously, and no one knows what happened to them (see LOST COLONY).

In 1606, a trading firm called the Virginia Company was granted a colonizing charter by King James. Two colonies were planned. One was to be located somewhere between present-day New York and the Carolinas. The other was to be someplace between New York and Newfoundland. The Virginia Company's plans led to the establishment of Jamestown and Plymouth. The experiences in these colonies served as a guide for future English colonization in America.

Jamestown was the first permanent English colony in America. The first colonists—all men or boys—landed on Jamestown Island on May 14, 1607. They set out to build a fortified outpost from which they could explore Virginia and trade with the Indians.

The Jamestown settlers expected to find gold and other treasures in the wilderness, but they found none. There was nothing they could send back to England for sale except lumber products. About 1612, the colonists learned how to raise and cure tobacco. The export of tobacco helped save the colony by providing a way for the colonists to support themselves.

Many serious difficulties almost ruined the settlement. The region was swampy and unhealthful. During the first year, about two-thirds of the settlers died of disease or starvation. More settlers were sent to Jamestown, but food was still scarce. So many died in 1609 that the year became known as the colony's "starving time."

Indian attacks added to the difficulties in founding the colony. The attacks stopped after the settlers signed a treaty in 1614 with Chief Powhatan, whose daughter Pocahontas had married John Rolfe. But the Indians broke the treaty after Powhatan's death in 1618. They killed many settlers in a massacre in 1622.

In spite of many tragedies and hard times, Jamestown survived. Farmers and their families replaced the explorers and traders. The Virginia Company also sent young women to Jamestown to marry the bachelors of the colony. There were two chief reasons for the survival of the Jamestown colony. First, the colonists learned how to produce their own food and supplies. Second, family life developed after women settled in the colony. For the story of the Jamestown settlement, see JAMESTOWN; VIRGINIA (History).

Plymouth was the second permanent English settlement in America. A group of Pilgrims—men, women, and children—established the colony in 1620 on the rocky southeastern shore of what is now Massachusetts. The Plymouth colonists called themselves Pilgrims because of their wanderings in search of religious freedom. The Pilgrims were farmers and skilled workmen. They wanted to raise their families in a place where they could live according to their religious beliefs. These beliefs required the Pilgrims to work hard and live simply.

Although the Pilgrims were quite different from the Jamestown settlers, they had many similar problems.

PHILADELPHIA MARKET

Certain days of each week were declared "market days" in every colonial city. On those days, the farmers of the surrounding countryside brought fresh meats, fruits, and vegetables to be sold in the city's special market areas. This painting was adapted from a print made in the late 1700's.

Their "starving time" came during the first winter, just after they landed in the New World. Only about half the 99 Plymouth settlers survived the bitter winter.

The Pilgrims were fortunate in their relations with the Indians of the region. Soon after the Pilgrims landed, they signed a friendship treaty with the Indians which lasted 50 years. They also had the help of a friendly Indian named Squanto. He taught them how to raise corn, and showed them the best fishing areas. See SQUANTO.

The story of how the Pilgrims established Plymouth Colony has become one of the most famous chapters of American history. This story is often told to show how courage and hard work can triumph over tremendous difficulties. The Pilgrims did not change their simple way of life as their colony developed. As a result, Plymouth never became prosperous. In 1691, it became part of the large colony of Massachusetts. For the story of how the Pilgrims developed their colony, see PLYMOUTH COLONY. See also PILGRIM.

Development of the Colonies

After English colonists had settled Jamestown and Plymouth, large areas of the Atlantic seacoast were colonized. The later colonists suffered hardships, but they had learned from the first settlers. There were no more "starving times" in colonial America.

The colonies are generally grouped according to location: (1) the Northern or New England Colonies, (2) the Middle Colonies, and (3) the Southern Colonies.

The Northern Colonies were Connecticut, Massachusetts, New Hampshire, and Rhode Island. Most New Englanders lived in villages and had small farms. The climate was too cool and the soil too rocky for large farms. New England Colonies had plenty of fine timber and some of the best fishing waters in the world.

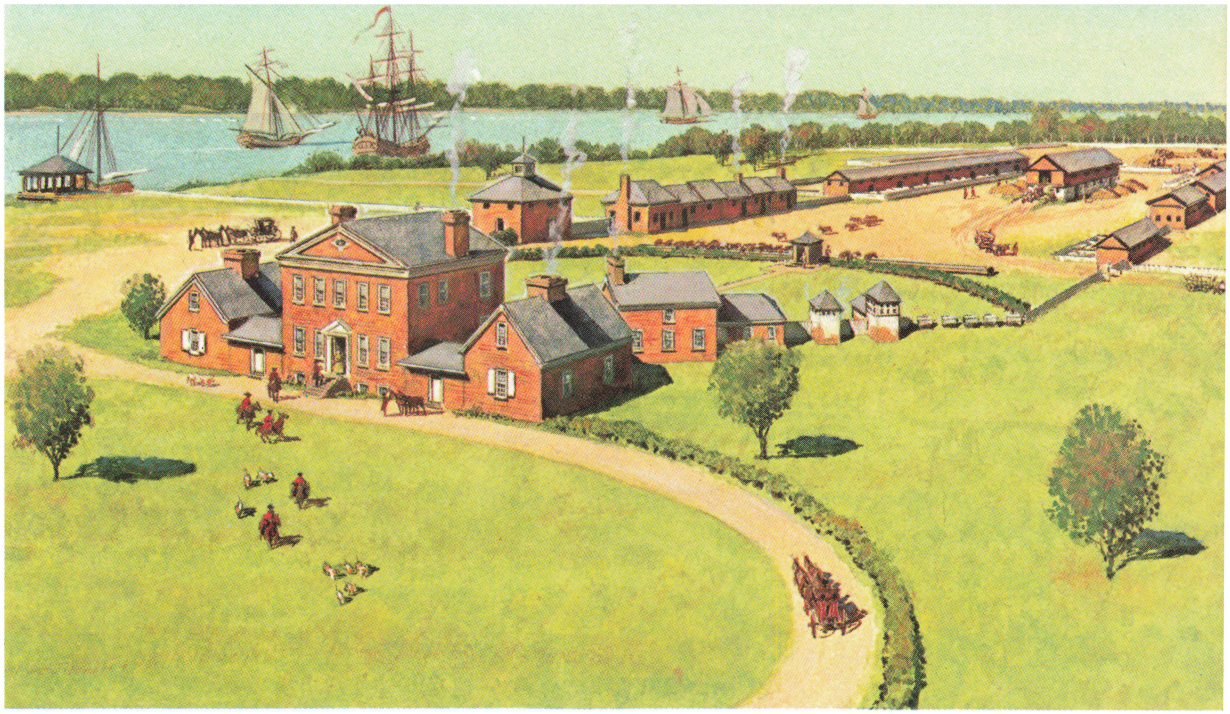
The Middle Colonies were Delaware, New Jersey, New York, and Pennsylvania. Their climate favored large farms, where wheat and other grains were grown.

The Southern Colonies were Georgia, Maryland, North Carolina, South Carolina, and Virginia. The warm climate and rich soil of the south were fine for growing tobacco and rice. Life in the Southern Colonies developed chiefly on plantations.

Types of Colonies. No two colonies began or developed in exactly the same way. But there were three major types of American colonies: (1) *royal*, (2) *proprietary*, and (3) *corporate*. A royal colony was under the direct control of the king. A proprietary colony was controlled by an individual—the proprietor—under a grant from the king. A corporate colony was operated, as a rule, under a charter obtained from the king by a company's stockholders.

All the 13 English colonies were founded either as proprietary or corporate colonies. By the time the Revolutionary War began in 1775, eight of the colonies had become royal colonies—Georgia, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, South Carolina, and Virginia. Three colonies—Delaware, Maryland, and Pennsylvania—were proprietary. The other two—Connecticut and Rhode Island—may be considered corporate colonies. Their charters were obtained by groups of colonists in America, not by stockholders in England.

Growth in the 1700's. The settlement of America increased rapidly during the late 1600's and the 1700's. Most of the new immigrants made their homes in the Middle Colonies, but others settled in New England or the Southern Colonies. The immigrants included



SOUTHERN PLANTATION

A colonial planter built his mansion to resemble a fine English country house. Behind the mansion were a kitchen, smokehouse, coach house, barns, and slaves' cabins. Most plantations were on a bay or river and had a wharf where their products could be loaded on ships.

large groups of Germans and Scotch-Irish. Like many of the early settlers, these groups had fled hard times and religious persecution in Europe. The Germans became known as the best farmers among the colonists. The Scotch-Irish won fame as the best Indian fighters.

The birth rate in America during the 1700's was probably higher than that of any other country. As a result of this high birth rate and increased immigration, the population of the colonies grew rapidly. It was about 250,000 in 1700, and increased to more than 1 million by 1750. The population doubled to over 2 million by 1770, and in 1775, there were nearly 2,500,000 persons in the colonies.

Population estimates made in 1770 show that the Southern Colonies had almost as many persons as New England and the Middle Colonies combined. The southern population was close to 1 million, New England's was about 571,000, and that of the Middle Colonies was about 556,000. Virginia was by far the largest colony, with over 447,000 persons. Massachusetts had more than 266,000 persons, and Pennsylvania was third, with over 240,000. Georgia, with about 23,000, had the smallest population.

As the population of the colonies increased, trade and manufacturing developed rapidly. These activities centered mainly in towns that had good harbors. Five towns became the most important American cities of the 1700's. They were, in order of size of population: Philadelphia, New York City, Boston, Charleston (called Charles Town in those days), and Newport.

Philadelphia was the busiest colonial port and the largest manufacturing center of the mid-1700's. In 1760, Philadelphia had over 23,000 people, and by 1775 its population had grown to about 40,000. New York City had a population of about 25,000; Boston, 16,000; Charleston, 12,000; and Newport, 11,000.

Relations With the Indians

In some places, the Indians were friendly and helped the settlers. Elsewhere, the tribes tried to drive the colonists out of lands that had been Indian hunting grounds for thousands of years. Then terrible wars broke out. For a description of the battles, see INDIAN WARS.

The struggles between the colonists and the Indians became large-scale warfare because of fighting between England and France. In a series of wars from 1689 to 1763, the English and French sent troops to America and battled each other for land. In these wars, many English colonists fought French colonists who had settled in Canada and the Mississippi Valley. Each side had strong supporters among the Indian tribes. For that reason, the colonists called the wars the French and Indian Wars. England won, and France lost almost all its possessions in North America. For the details of these wars, see FRENCH AND INDIAN WARS.

After their victory, the English recognized the claims of the Indians to the western lands that the tribes occupied. In 1763, the English issued a proclamation which prohibited American colonists from settling west of the Appalachian Mountains. Land there was reserved for the Indians. The English hoped to prevent fighting between the colonists and the Indians.

Settlers who were ready to move to lands beyond the Alleghenies refused to obey the proclamation. Opposition by the colonists to the Proclamation of 1763 became one of the issues leading to the Revolutionary War (see REVOLUTIONARY WAR IN AMERICA [Events Leading to the Revolution]).

An engraving from *A Popular History of the United States.* Library of Congress

America's First Representative Legislature, the General Assembly, met at Jamestown in 1619. Its elected members, with the governor and council, made the laws of Virginia.

COLONIAL LIFE IN AMERICA / *Society and Government*

Colonial Society was made up of several classes. At the top were rich merchants and planters, and their families. They were called the "gentry" or the "better sort." The gentry lived in mansions and often traveled in comfortable carriages. The men used "Esquire" after their names, and their wives were addressed as "Madam." The gentry were well educated and included ministers, doctors, or lawyers who had attended a university.

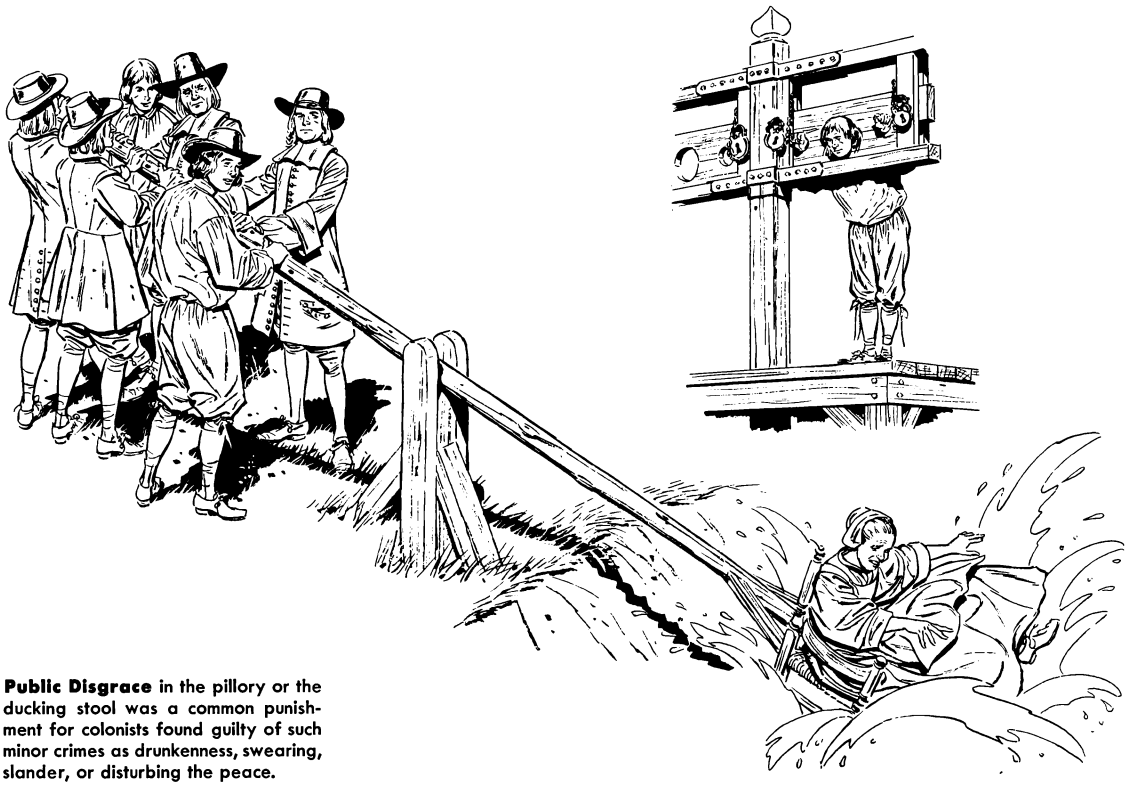
Below the gentry were members of the "middling sort." Most of them were farmers or shopkeepers who owned property but were not wealthy. Some craftsmen and teachers were included in the "middling sort." The lowest rank, called the "meaner sort," consisted of poor people, including unskilled laborers, slaves, and *indentured servants.* An indentured servant was a person who came to the colonies under a contract to work for a master without wages. Instead of paying wages, the master paid for the servant's passage from Europe. The servant also received food, clothing, and housing. Most contracts covered a period of four to seven years.

Colonial society was the most democratic in the world, because members of the lower classes, except slaves, could easily rise to a higher class. A successful farmer could become the owner of a large estate. Then, if he sent his sons to college, they became members of the gentry. A craftsman or shopkeeper might become a wealthy merchant. An indentured servant, after serving the term of his contract, was given either land or craftsman's tools. He became a farmer or set up his own business. Skilled workers earned good wages, and could invest their money in property or in some business.

Only slaves were forced to spend their lives at the lowest level of society. They were Negroes, originally brought from Africa and sold to wealthy colonists. Slaves and their children remained slaves unless their master freed them. But a free Negro generally found it hard to make a living. If he left home, he might be arrested as a runaway slave and sold into slavery again. He usually stayed in the neighborhood where people knew him, and worked for low wages. Most slaves worked in the Southern Colonies as farm laborers or house servants. In New England and the Middle Colonies, slaves usually worked in homes or shops.

Government. Each colony had a governor and a legislature. The king of England appointed the governor of royal colonies. In proprietary colonies, the proprietor named the governor. In Connecticut and Rhode Island, the people elected the governor. Most colonial legislatures consisted of two houses, and resembled the English Parliament in structure. Today, state legislatures still have that basic structure except for Nebraska, which has a one-house legislature.

A colonial legislature was called an Assembly, except in New England, where it was known as a General Court. The people elected the members of the lower house in all the colonies. In Connecticut and Rhode Island, the people also elected the members of the upper house. In Massachusetts, the upper house was elected by the lower house. In the other colonies, the king or the proprietor appointed the upper house.



Public Disgrace in the pillory or the ducking stool was a common punishment for colonists found guilty of such minor crimes as drunkenness, swearing, slander, or disturbing the peace.

The laws passed by a colonial legislature had to be approved by the English government. Governors appointed by the king had the responsibility of carrying out his orders. The king expected them to enforce the laws of England, especially acts of Parliament that regulated colonial trade.

Voting Requirements differed in the various colonies, and changed from time to time. One of the most important requirements was property ownership. By 1750, most adult male citizens who owned property could vote. Land was considered the basic property, but other possessions could be substituted for it. A tenant farmer could vote if he owned valuable livestock, or a merchant who did not own his shop could vote if he owned valuable goods. Those who could not vote included women, indentured servants, slaves, and the very poor.

Most of the colonies limited voting and other rights of citizenship to members of a certain church group. In the royal colonies, all citizens had to be members of the Church of England, often called the Anglican Church. In colonies controlled by the Puritans, all citizens had to belong to the Congregational Church. As a result, Roman Catholics and Jews could not vote in most of the colonies.

The rules that governed citizenship and voting in the colonies seem highly undemocratic today. But in colonial times, these laws were broader than those of any other country, including England. The colonists based their laws on certain ideas that suited their social system and business life. They believed that men who owned property had a strong interest in good government. The gentry had the time, talent, and experience for public service, and the voters usually elected them to office. In most elections, about half of those qualified to vote went to the polls.

Local Government in the colonies was based on English county and town governments. In the south, the county court conducted most public business. This court consisted of justices of the peace, appointed by the governor. They levied taxes, supervised road construction and ferry service, and organized the *militia* (citizen soldiers). They also tried certain civil and criminal cases. In New England, the courts only tried cases. Citizens held town meetings at which they voted on local laws and elected town officials, called selectmen. The town meeting still exists in some New England towns (see TOWN MEETING). In the Middle Colonies, local governments consisted of both county and town units.

Law Enforcement in the colonies was the job of constables and sheriffs. Persons accused of a crime punishable by death were tried by certain high courts in the colonial capitals. Death by hanging was the customary penalty for such crimes as armed robbery, counterfeiting, murder, piracy, or treason.

Local courts with juries tried persons accused of such minor crimes as drunkenness, slander, swearing, theft, disturbing the peace, or breaking the Sabbath. Punishment included fines, public whipping, and suffering disgrace with the pillory, stocks, or ducking stool (see PILLORY; STOCKS; DUCKING STOOL).

Colonial households were large because grandparents, aunts, uncles, and cousins generally lived with the family. Servants also belonged to the family group. All members of the group worked together to support the household.

A colonial father decided important matters affecting the household. His wife, children, and servants obeyed him without question. By law and custom, he was responsible for the behavior and welfare of every member of the household.

Houses. The first settlers built houses that closely resembled those they had known in Europe. The colonists later changed their housing styles so they could make the best use of local building materials. The first cottages of Jamestown and Plymouth had thatched roofs, like English cottages. After the colonists found wood more plentiful than reeds or straw, wood shingles replaced thatch.

All the colonies had plenty of wood, and frame houses could be seen everywhere. In the Northern Colonies, where winters were very cold, the colonists built brick or stone chimneys inside the framework to supply warmth. In some homes, one chimney served several fireplaces. In the Southern Colonies, which had a generally mild climate, chimneys stood outside the framework of most homes.

Most early southern houses had $1\frac{1}{2}$ stories. A typical New England house of the 1600's had two stories in front and one in back. Some New England homes were built of the fieldstone that the colonists found in many areas. In areas near the Appalachian valleys, limestone was used to build many houses. Bricks were made in every colony during the 1700's, but wood cost less and remained the most popular building material throughout the colonial period.

Many houses in the Delaware and Hudson river valleys were of Scandinavian or Dutch design. The Swedish colonists who came to Delaware in 1638 built the first log cabins in America. The log cabin became the typical home of the pioneers who moved westward (see LOG CABIN). Most of the houses built by the Dutch settlers had $1\frac{1}{2}$ stories. Their doors were divided into upper and lower parts which opened separately. These doors became known as "Dutch doors."

Many wealthy colonial merchants and planters built homes in a style called Georgian architecture. Most Georgian houses were square or rectangular, with a central stair hall and many tall windows. The front door was large and impressive, and the main rooms had fine wood paneling. See GEORGIAN ARCHITECTURE.

The mansion of a typical southern plantation stood on a hill and overlooked a bay or river. It was surrounded by gardens, orchards, and shade trees, with a kitchen, laundry, and smokehouse nearby. Farther away were the stables and carriage house, and cabins where the slaves lived.

Some wealthy South Carolina colonists developed a type of town house that was especially suited for the climate of Charleston. A Charleston town house was only one room wide, but had three or four stories and several porches. Cool sea breezes swept through every room of these tall, narrow homes.

Furnishings of the first settlers were homemade, except for a few possessions brought from Europe. Many families made most of their own furniture and other household articles throughout the colonial period. Wealthy colonists imported their furnishings, generally from England. After colonial cabinetmakers developed their craft, the homes of the well-to-do had much fine American furniture.

The homemade furnishings of the settlers were plain and strong. Thick wooden planks, set on sturdy supports, served as a table. Blocks of wood, small barrels, or rough benches and stools were used as chairs. Mattresses were canvas bags, stuffed with straw and placed on the floor or on bedsteads made of log slabs.

Life in most colonial homes centered around the fireplace. The women prepared food there, and cooking utensils hung nearby. The fireplace provided most of the family's heat and light, and everyone gathered in front of it to eat, work, relax, or entertain visitors. A spinning wheel stood on the hearth.

The homes of most wealthy colonists had finely designed tables, chairs, beds, chests, and sofas. Some of this furniture came from the shops of such great English furniture designers as Thomas Chippendale, George Hepplewhite, Thomas Sheraton, and the Adam brothers. After 1750, colonial craftsmen copied many favorite English designs. They used native cherry, maple, pine, or walnut, and also mahogany imported from the West Indies.

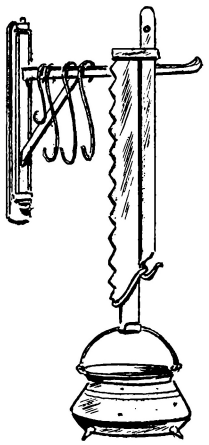
The chairs and sofas of a Georgian mansion were richly upholstered in leather, tapestry, silk damask, or embroidered linen. Benjamin Franklin attached rockers to the legs of a chair that had a straight back made of slats. The slat-back American rocking chair became popular in many parts of the world.

Tables were graceful, and many had special features that saved space. These features included folding legs, and tops fitted with drop leaves. The drop leaves were hinged parts that rested on the legs when the table was being used. At other times, the legs were folded and the drop leaves lowered.

The most popular chests of drawers were "highboys" and "lowboys." A highboy was large and tall, with many drawers and short legs. A lowboy was a small, low chest of a few drawers. A lowboy often served as a side table. Tall cupboards stood in the halls, bedrooms, kitchen, and dining room. Some, called dressers, were divided into an upper section of open shelves, and a lower section with doors. The open shelves were used to display dishes and pewterware.

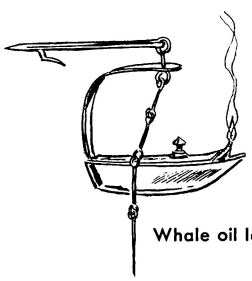
Most fine colonial bedrooms had a four-poster—a bed with a tall post at each corner. The four posts supported a *canopy* (overhead covering). Curtains hung from the frame of the canopy, and could be drawn together to keep out cold air. The mattress, stuffed with feathers, rested on woven ropes fastened to the bedstead several feet above the floor. The space between the floor and the mattress generally was used to store a child's bed during the day. This movable bed, called a trundle bed, was pulled out at night.

Some well-furnished colonial homes had a handsome clock. The most famous colonial clock was called a

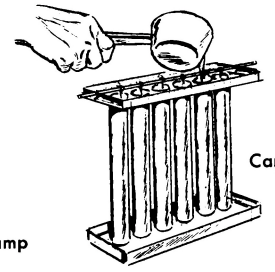


Iron cooking pot

Tinderbox

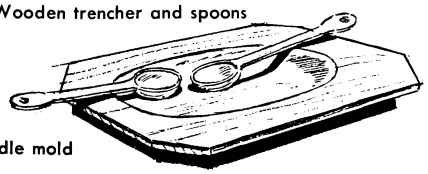


Whale oil lamp



Candle mold

Wooden trencher and spoons



Bed warmer

FARMHOUSE

Every member of the family shared in the tasks of a colonial household. The early settlers made most of their own clothing, furniture, and cooking utensils. In farmhouses throughout the colonies, the family gathered at nightfall to work in the light and warmth of the fireplace.

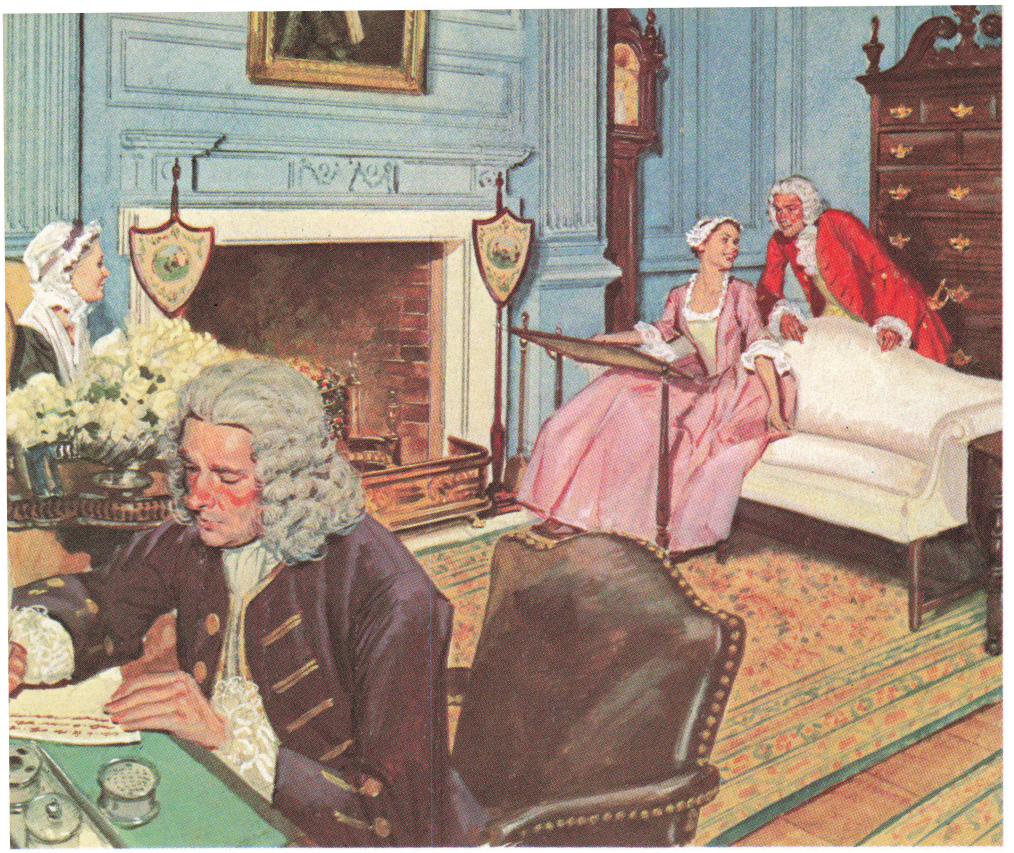
grandfather clock. It had a tall wooden case and stood on the floor. Other furnishings included candlesticks, chandeliers, and mirrors. The windows had heavy curtains made of brocade, damask, or linen. Floors were covered with imported carpets or colorful rugs, hand made in the home.

Clothing in colonial times varied according to a person's occupation or position in the community. A farmer and members of his family wore rough, homemade garments. A wealthy merchant or planter and his family had expensive clothing, made of imported materials and designed in fashionable English styles. Male servants who worked in the fields sometimes wore only breechcloths in summer.

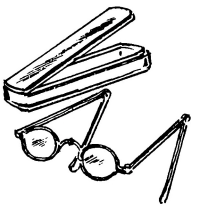
Making clothing was an important task in most colonial households. On small farms, the women planted and tended a patch of flax, harvested the crop, spun the yarn, and wove it into linen. They wove woolen cloth from yarn spun from the fleece of sheep. Linens and woolens were colored with dyes made from certain barks, berries, roots, or walnut hulls. The colonists tanned cowhide and deerskin, and made the leather into shoes or leggings.

In summer, workingmen wore breeches and a long linen shirt. In winter, they wore woolen or leather breeches, knitted stockings, and heavy shoes. For outdoor wear in cold weather, a man had a loose-fitting overcoat, leather leggings, woolen mittens, and a fur cap. A woman wore a dress of linen or wool, a petticoat, and a single undergarment called a shift. A cape or hooded cloak was worn outdoors. Children wore the same kind of clothes as adults.

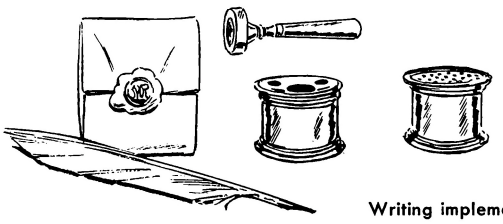
A wealthy colonist ordered fashionable clothing from London, or from a local tailor who copied the latest English styles. A typical style of the times called for close-fitting breeches of brocade, silk, or velvet, fastened



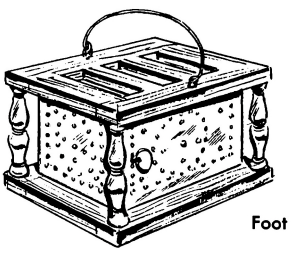
Fire screen



Spectacles



Writing implements



Foot stove

LIVING ROOM **During the 1700's, many wealthy colonists built mansions in a style known as Georgian architecture. The living room had paneled walls and a large, richly decorated fireplace. Much of the furniture of a colonial mansion was made by skilled craftsmen who copied fashionable English designs.**

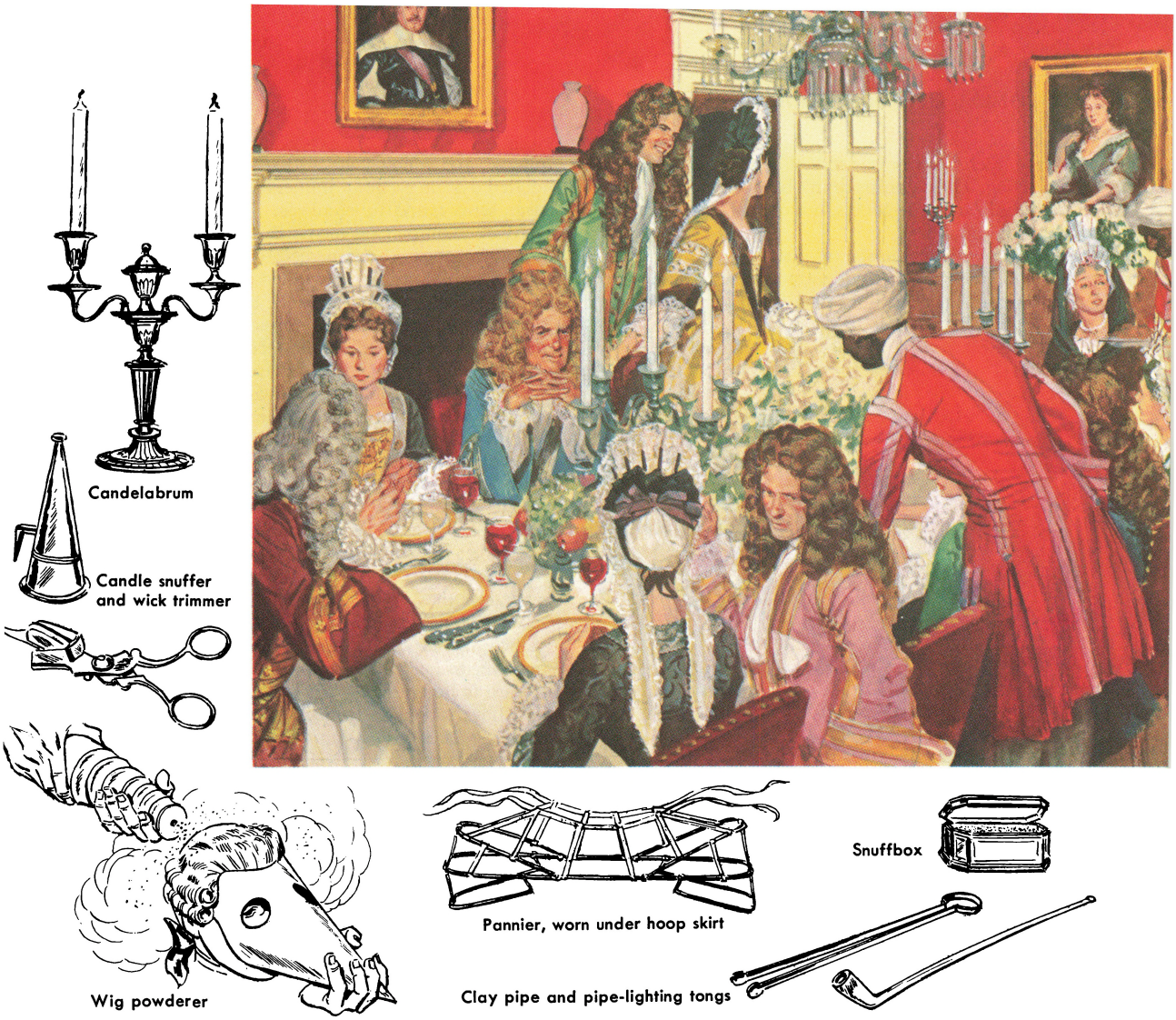
at the knees with silver buckles. With the breeches, a gentleman wore a white linen shirt with lace ruffles at the neck and wrists. Over the shirt, he wore a long, brightly colored waistcoat and a knee-length coat. The coat had wide, flowing sides, and was decorated with gold braid and several rows of fancy buttons. Silk hose, and shoes with silver buckles completed the costume.

A fashionable gentleman wore a wig that he sometimes powdered white. Outdoors, he put a black *cocked hat* (a hat with the brim turned up) on top of the wig. During the late 1600's, wigs were large and expensive. A man who wore one was called a "bigwig." After 1750, many colonial men wore wigs. The most popular wig was small and resembled the wearer's natural hair. It was called a "tie" wig because a man pulled it back and tied it with a short ribbon.

Women of wealthy families wore a low-necked dress with a tight-fitting bodice, and ruffles at the elbows. It had a full skirt, looped back to display a brightly colored embroidered petticoat. Under the dress, a hoop of steel or whalebone supported the skirt. A tightly laced corset pinched in the waist. A woman of fashion wore silk stockings and silk or leather shoes. She had several types of capes for outdoor wear.

During the 1600's, fashionable women generally wore simple hair styles. The hair was usually arranged so that a loose curl or two hung to the shoulder. Large, fancy hairdos became the fashion about 1760. Servants spent much time helping their mistress pile her hair high on a frame that she wore on her head.

Food was plentiful during most of the colonial period. After the first few years, the colonists kept themselves better supplied with food than any other people in the world. On their farms, they raised grain, cattle, hogs, sheep, chickens, fruits, and vegetables. In the fields and woodlands, they hunted deer, pigeons, squirrels, wild



DINING ROOM **Wealthy colonists entertained in the style of the gentry of England. They often held large dinner parties at which the guests enjoyed a wide variety of fine foods and wines. The chandelier, dishes, silverware, and table linen were all imported from London.**

turkeys, and other game. From the river and ocean waters, they took clams, oysters, lobsters, and many kinds of fish.

Corn was a basic food in almost every household. The people ate it in many forms, most commonly as corn bread. A woman mixed corn meal with water or milk, salt, and lard, and shaped it into buns. Then she baked or fried the buns on a hoe or on a griddle, or placed them in the ashes of the fireplace. Corn bread had different names in various parts of colonial America—ashcake, hoecake, johnnycake, or corn pone. Cooks also made corn hominy. Sometimes they roasted ears of corn in the husks.

Rye or wheat bread was made with yeast. In many homes, the women baked these breads in a small oven that was built into the fireplace or outside the house, against the hot chimney. They also baked bread in an iron bake kettle, which had a tight-fitting lid. The kettle stood on a bed of hot coals, with embers piled around it and on top of the lid.

Meat or game was usually cooked with vegetables into a stew. Women made the stew in a large iron pot that hung over the fire on a pothook, fastened to a crane or a chimney bar. The iron pot had short legs and sometimes was placed on a bed of coals. Whole fowl or large cuts of meat were often roasted on sharp-pointed rods called spits. Handles on the spits allowed the meat to be turned above the fire.

The colonists had difficulty storing food for the winter because they had no methods of canning or refrigeration. They salted or smoked some meats, and dried or pickled certain vegetables. Root vegetables, and such fruits as apples or pears, were kept in cool, dry cellars. As a rule, the colonists depended on bread and meat for their food during the winter.

Most families ate bread and cold meat for breakfast

and supper. Dinner was served at noon or early in the afternoon. The colonists drank beer, cider, rum, or wine with dinner. In the 1700's, hot chocolate, coffee, or tea became popular.

Health of the colonists was poor by today's standards. Most of the people frequently suffered some type of illness, and they did not know how to treat or prevent many serious diseases. But no one in Europe or anywhere else knew how either. The general health of the colonists was no worse than in any other part of the world.

Contagious diseases sometimes spread rapidly and took many lives in the colonies. The settlers had epidemics of measles, smallpox, typhoid fever, bubonic plague, and yellow fever. Other widespread illnesses included dysentery, gout, influenza, pneumonia, rheumatism, scurvy, and tuberculosis.

Detail from the frontispiece to Dilworth's *New Guide to the English Tongue*. Folger Shakespeare Library, Washington, D.C.

Children's Games in colonial times included many that are still popular. The youngsters shot marbles, flew kites, and played hopscotch, leapfrog, prisoners' base, and blindman's buff.

Shearing Sheep and cutting bristles from hogs supplied materials for many colonial household items. The sheep's wool was spun into yarn, and the hog bristles were used to make brushes.

From *Alle de Wercken*, 1657-59, by Jacob Cats. Folger Shakespeare Library, Washington, D.C.

Most colonists took medicines made of certain barks, herbs, or roots. These medicines, although believed to be powerful cures, usually failed. One helpful medicine was quinine, a bitter substance taken from the bark of the cinchona tree. The colonists used it for a common malarial fever called ague. Doctors still use quinine to treat certain types of malaria. Popular medicines were made from tobacco leaves and the roots of the ginseng plant and the sassafras tree.

There were few trained doctors and nurses during most of the colonial period. Most doctors studied medicine by helping experienced physicians. One of the first public hospitals in America was the Pennsylvania Hospital. It was chartered in Philadelphia in 1751, and still serves the community.

Recreation. The colonists combined work with play whenever they could. They often gathered to perform some task together and, at the same time, to enjoy games, contests, and other recreation. Neighbors got together to help a newcomer build a barn or a house. A barn or house raising was an opportunity for the men and boys to stage foot races, or shooting or wrestling contests. They also competed in plowing or corn husking. The women and girls held quilting bees, and everyone enjoyed spelling bees and singing groups. All these activities gave the people a chance to share good things to eat and drink, and to exchange news and gossip.

Weddings and holidays were important occasions for feasting and amusement. Many wedding celebrations lasted several days, during which the guests feasted, danced, and played card games. Christmas was a gay holiday season in most of the colonies. But some New England colonies followed the Puritan custom in England and outlawed the celebration of Christmas. They added Thanksgiving Day to the fall calendar as a harvest feast. Several colonies celebrated May Day as a spring festival.

Horse racing became popular in most of the colonies during the late 1600's. Virginians raised a special type of horse for their sport of *quarter racing*, a quarter-mile (0.4-kilometer) race along a straight path. Cockfighting was also popular in the south. Everywhere, fishing and hunting were favorite sports which kept colonial households well supplied with fresh foods.

The colonial tavern, sometimes called an "ordinary," developed as a favorite gathering place for men. The men gathered in the tavern to talk, smoke, eat and drink, play cards, or read a newspaper. Many taverns had a bowling green, a smooth, flat plot of grass where their customers could bowl.

Colonial children played many games that are still popular, including hopscotch, leapfrog, London Bridge, hide and seek, prisoners' base, and blindman's buff. Colonial toys included balls, dolls, marbles, kites, tops, rolling hoops, and jump ropes. Most toys were homemade, but rich children had doll tea sets or toy soldiers that were imported from England. Almost every household had several cats and dogs, and children who lived in the country made pets of young farm animals.

The Church strongly influenced the social and political life of colonial times. Most of the colonists were deeply religious. Many had come to America chiefly so they could worship according to their beliefs. In Europe, many religious groups had been persecuted for trying to establish new forms of worship.

Most colonial religious groups dated from the 1500's. They developed during the Reformation, a religious movement in Europe that resulted in the birth of Protestantism. King James I of England opened the way for religious freedom in the New World by allowing the Pilgrims to worship as they pleased. Many Puritans, Quakers, Baptists, Huguenots, and other persecuted groups then left Europe and established churches in the colonies. These groups did not always grant religious freedom to those who disagreed with them. The Puritans established the Congregational Church in New England. They denied citizenship to Quakers and others who believed in a different form of worship.

In most of the colonies, church officials performed important public services which today are generally the work of government agencies. They supervised education and care of the poor, and kept records of baptisms, marriages, and deaths. The people used their church building not only as a place of worship, but also for community gatherings. Before and after worship, the churchyard served as a social center for courtship, neighborly visits, and the exchange of news.

During most of the colonial period, church laws governed the behavior of the colonists in almost all activities. The courts enforced these laws. Rules governing behavior were particularly strict in New England. They required everyone to observe the Sabbath from Saturday afternoon until sundown on Sunday. Such tasks as cooking, shaving, cutting hair, or making beds were forbidden. Everyone was expected to spend the time in prayer. Certain strict Sabbath laws of the New Haven colony became famous as "blue laws." They were given that name because they were bound in blue paper. Today, the term is used for restrictions on some activities or on certain forms of recreation on Sunday. See BLUE LAWS.

The colonists brought many ancient superstitions with them from Europe. These superstitions included the belief that certain women had evil powers, given them by devils. The women were accused of casting spells on their neighbors or practicing other forms of witchcraft. During the 1600's, the colonists persecuted many women as witches. Some of these women were imprisoned, and a few were executed. The persecution of suspected witches reached a climax in the famous Salem witchcraft trials of the early 1690's. See SALEM (Mass.); WITCHCRAFT.

Strong democratic ideas in religion spread through the colonies during the 1740's. That period is often called the time of the Great Awakening. Traveling preachers called evangelists held revival meetings in churches and open fields. The outdoor religious meetings attracted thousands of men and women of the lower classes of colonial society. The evangelists pleaded with the people to repent their sins and seek salvation. The experience of salvation, declared the evangelists, made all men equal in the sight of God.

The stirring sermons of George Whitefield and other famous evangelists aroused great excitement. But certain ministers of established churches opposed many evangelistic ideas. These ministers feared that strong ideas about equality might weaken their power to make church rules. In spite of such opposition, the Great Awakening developed a new interest in the importance of the common man. See GREAT AWAKENING.

The School. The children of rich colonists attended private schools or were educated by private teachers called tutors. The colonists established some public schools, but most children of poor families were taught by their parents at home. Some parents did not know

Preaching at Revival Meetings during a period known as the Great Awakening, George Whitefield, the famous evangelist, aroused excitement among colonists of the lower classes.

Bettmann Archive

Most Colonial Schoolchildren came from rich families. Poor children were usually taught at home by their parents. They learned skills that helped support the household.

Colonial Williamsburg

how to read or write, so they could not teach those skills. Most parents taught their children obedience, religious beliefs, and the skills they needed in daily life. Boys learned how to farm, raise cattle, and handle a gun. Girls learned such household tasks as sewing, spinning, and weaving, and how to cook and preserve food.

The first public school system supported by taxes was set up in New England in 1647. That year, a Massachusetts law called for every town with at least 50 families to establish an elementary school. Larger towns were expected to establish a secondary school, called a grammar school. But parents could still teach their children at home, and the wealthy could send theirs to private schools.

New England had many private schools called "dame" schools. Women, some of whom were widows, held these schools in their homes. They taught the alphabet, spelling, writing, and simple arithmetic. The children used *hornbooks* to memorize their lessons. A hornbook was a board with a sheet of paper pasted on it. On the paper were the alphabet, numerals, and the Lord's Prayer. A thin sheet of transparent horn covered the paper. See HORNBOOK.

Most of the colonies had some private schools that had been established as free schools. These schools were supported by charitable gifts for the education of the poor. Church groups operated many schools, and a minister often held classes in his home. Most of the students paid fees. In the south, planters hired tutors who became members of the plantation household.

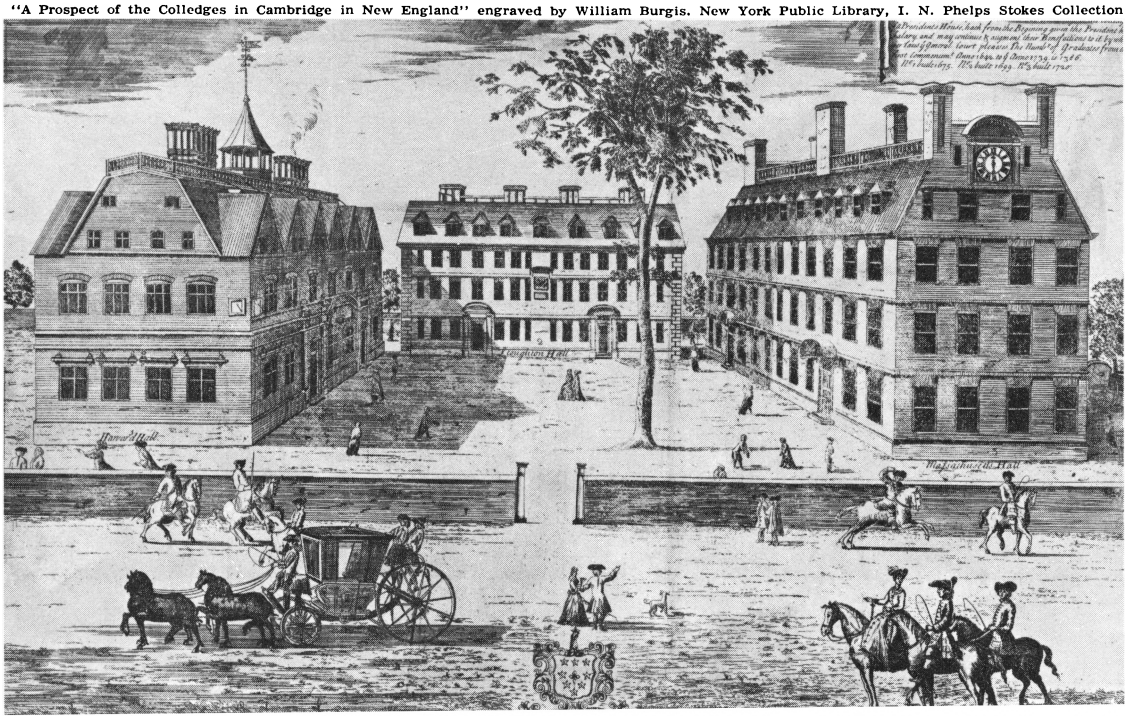
If a student's parents could afford to send him to college, he prepared for it in a grammar school. There he studied Latin, mathematics, geography, science, philosophy, and English composition and literature. Many sons of wealthy colonists attended college in England. The first colonial college was established in Massachusetts in 1636. It became Harvard University.

In every colony, many poor children got some education by serving as *apprentices* (learners). Under the apprentice system, a boy's parents placed him with a master craftsman, tradesman, or professional man. The master taught his skills to the boy, and provided him with food, clothing, and lodging. He also gave the boy religious instruction and taught him to read and write. In return, the boy promised to work hard, study faithfully, and be obedient and well-behaved. For most boys, an apprenticeship was the only way to learn a craft, trade, or profession. Some sons of wealthy families also served apprenticeships, especially in becoming lawyers. Girls were "bound out" by their parents as household servants, or apprenticed to become housekeepers, cooks, or needleworkers.

An Apprentice learned to read and write while serving a master who also taught the boy the skills of a craft or trade.

The First College in the Colonies was founded in Massachusetts in 1636. It later became Harvard University.

"A Prospect of the Colledges in Cambridge in New England" engraved by William Burgis. New York Public Library, I. N. Phelps Stokes Collection



Travel. Most of the early colonists rarely traveled far from home. As a rule, long journeys were made only by traders, or wealthy merchants or planters. These men generally traveled for business or pleasure by boat on rivers, bays, and the coastal waters. Freight and passengers were carried in many types of sailing vessels, including brigantines, schooners, shallops, sloops, and yawls. Large ships that sailed across the ocean carried small boats. These could be put over the side for travel on shallow inland waters.

Land transportation was slow and difficult. The first colonial roads were merely paths that followed ancient Indian trails through the woodlands. The colonists widened the paths for travel on horseback, and later for carts or wagons pulled by horses or oxen. Ferries carried travelers across rivers. Most of the wooden bridges built by the colonists could be used only by foot travelers, not by vehicles. By 1760, Philadelphia had two stone bridges.

The colonists put much effort into building roads. By 1760, a person could travel by road from New Hampshire to Georgia. At about the same time, stagecoach service linked Boston with Providence, and New York City with Philadelphia and Annapolis.

By the mid-1700's, comfortable passenger vehicles were being used in the towns by government officials and wealthy colonists. These vehicles included carriages, chariots, and coaches, drawn by four, six, or eight horses; two-horse chaises, curricles, and phaetons; and one-horse "riding chairs." Many carriages had richly carved wooden sides, and seats upholstered in leather or brightly colored cloth. Brass or silver ornaments decorated the harnesses.

Communication. During the 1600's, the colonists exchanged news chiefly by word of mouth. Someone would learn about an event from a peddler or a ship captain, and repeat the story to his neighbors. Friends exchanged news in letters that they often gave to travelers to deliver.

News was also spread by *postriders*, the first colonial mailmen. A postrider carried letters or messages, traveling on horseback along a certain route called a post road. On the way, he picked up news and passed it on to the men who welcomed him at taverns and post offices. In most towns, a town crier read official messages to the people.

Mail service operated irregularly in colonial times. Until 1700, it existed only in Massachusetts, New York, and Pennsylvania. In 1753, Benjamin Franklin of Pennsylvania and William Hunter of Virginia were appointed to manage the colonial postal service. Under their direction, post offices were established in all the colonies, and service improved greatly.

Newspapers came into general use after the mid-1700's. The first successful American newspaper, *The Boston News-Letter*, had started publication in 1704. During the next 60 years, newspapers were published in every colony except Delaware and New Jersey.

Bettmann Archive

A Town Crier read official announcements to the townsfolk until newspapers came into general use in the mid-1700's.

Etching of an old Pennsylvania inn by E. T. Scowcroft. Free Library of Philadelphia

Colonial Stagecoaches began operating in the mid-1700's. Taverns provided food and lodging along the way.

The task of building homes and communities in a rugged land demanded great energy and effort. The early colonists had little time for the arts or sciences. In 1743, Benjamin Franklin wrote that "the first drudgery of settling new colonies" was done and there could be "leisure to cultivate the finer arts and improve the common stock of knowledge." By the end of the colonial period, some colonists had made important contributions to literature and painting. Others were active in such scientific fields as astronomy and botany.

Literature. The earliest descriptions of colonial life were written to tell Europeans about the settlements in the New World. John Smith wrote about Jamestown and New England, William Bradford described the Plymouth Colony, and John Winthrop told of the Massachusetts Bay Colony.

Religious writings made up the bulk of colonial literature published in America during the 1600's. The first book printed in the colonies was a collection of psalms, published in 1640. Several ministers prepared this book, which became known as *The Bay Psalm Book*. Three religious leaders—Jonathan Edwards, Cotton Mather, and John Woolman—wrote many books and pamphlets during the 1700's.

Colonial poets also dealt chiefly with religious subjects. Michael Wigglesworth, a New England poet, wrote *Day of Doom*, the most popular literary work of the time. Anne Dudley Bradstreet, another New Englander, became America's first woman poet. She is best known for her collected poems, *The Tenth Muse Lately Sprung Up in America*.

Writings on political subjects became important in the mid-1700's. Dozens of revolutionary pamphlets and poems were circulated after Great Britain passed the Stamp Act of 1765 (see STAMP ACT). Benjamin Franklin was one of the most influential political writers, but he did not limit himself to politics. Franklin's witty proverbs helped make his *Poor Richard's Almanac* a favorite publication of the colonists. For a detailed account of colonial writers and their works, see the WORLD BOOK article on AMERICAN LITERATURE.

Painting. During the mid-1700's, several young colonists were trained by visiting European artists. These American artists, who went to Europe for further study and became world famous, included John Singleton Copley, Charles Willson Peale, Gilbert Charles Stuart, and Benjamin West.

Earlier artists, called *limners*, had little training. They traveled about and earned a living by painting portraits of wealthy colonists. Well-known limners included Charles Bridges, Gustavus Hesselius, Henrietta Johnston, John Smibert, and Jeremiah Theüs.

Science. During most of the colonial period, educated men had broad scientific interests. Many of these men worked to improve education and expand scientific study in the New World.

Benjamin Franklin won honors throughout the world for his scientific experiments and inventions. He led all the men of his day in the study of electricity. In 1752, Franklin flew a homemade kite during a thunderstorm, and proved that lightning is electricity. Then he invented the lightning rod, a way to tame electricity. See FRANKLIN, BENJAMIN (The Scientist).

Franklin also encouraged other scientists. In 1727, he formed the Junto, a debating club. Most of the members were interested in science as well as politics. They met regularly in Philadelphia to exchange ideas. In 1743, Franklin founded the American Philosophical Society, which became the chief center of colonial science.

John Bartram was the most famous botanist of the period. In 1728, he planted America's first botanical garden. Other noted colonial botanists included John Banister, John Clayton, Cadwallader Colden, John Mitchell, and Alexander Garden, for whom the gardenia was named.

Colonial scientists of the 1700's were well informed about new discoveries in astronomy, chemistry, meteorology, and physics. They often exchanged ideas with European scientists. Many performed laboratory experiments or kept records of rainfall, temperature, and the appearance of comets.

Documentary Script, surrounded by floral designs in color, was developed as an art by a number of German colonists.

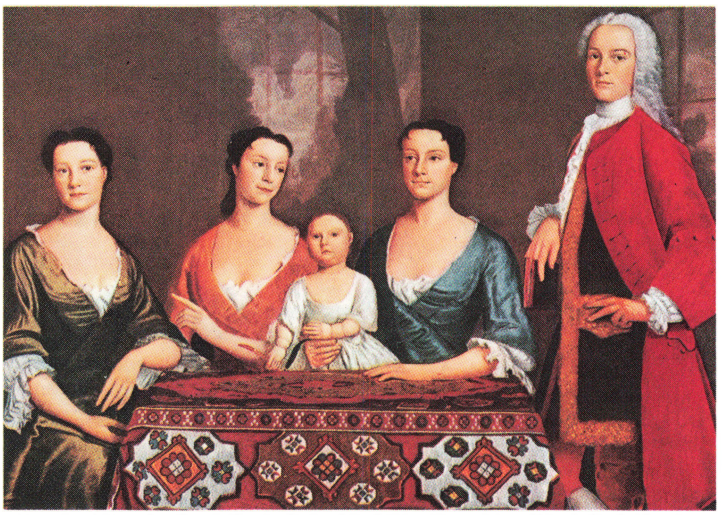
Baptismal Certificate by Henrich Otto. Free Library of Philadelphia

Colonial Architecture has been preserved in the stately Governor's Palace reconstructed in Wiliamsburg, Va.

Colonial Williamsburg

Mrs. Thomas Van Alstyne by an unknown artist. New York Historical Society

Woman's Portrait, by a colonial artist with little training, has a glaring error. The subject is shown with two right hands.



Portrait of Isaac Royall and His Family by Robert Feke. Harvard Law School, Cambridge, Mass.

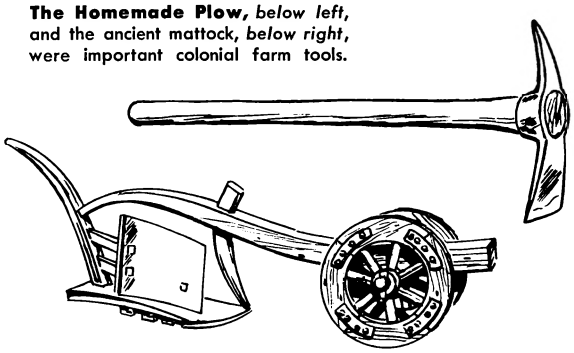
Painting of a Distinguished New England Family is a fine example of the work of Robert Feke, a colonial artist whose portraits have become famous.

"The Duke's Plan of 1661," one of the earliest maps of a colonial city, was made a few years before the English captured New Amsterdam and named it New York.

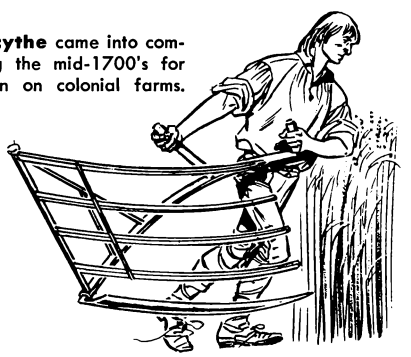
British Museum, London

Planting Corn for Food, a skill learned from the Indians, saved many early settlers from starvation.

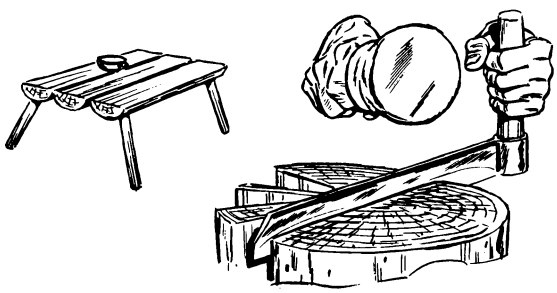
The Homemade Plow, *below left,* and the ancient mattock, *below right,* were important colonial farm tools.



The Cradle Scythe came into common use during the mid-1700's for harvesting grain on colonial farms.



The Wedge-Shaped Iron Froe, a basic colonial tool, was often used to split logs into the slabs that made a sturdy table.



Throughout the colonial period, farming was the most important way of making a living. Farming meant survival for the first settlers. To stay alive, they had to produce food, along with materials for clothing and shelter. As their settlements grew, the colonists raised grains, tobacco, livestock, and other farm products for export. They also developed such industries as fishing and whaling, lumbering, shipbuilding, ironmaking, rum distilling, and flour milling. Colonial craftsmen made furniture, glassware, pottery, and metalware of pewter, iron, or silver.

Farming

Most colonial farmers were successful because they worked hard and land was plentiful. By today's standards, colonial farming methods were wasteful. The colonists usually planted the same kind of crop repeatedly, and the soil became exhausted after a few harvests. Then the farmers simply cleared more land. The most skillful farmers were the German settlers, who rotated their crops and added fertilizers to the soil. These methods kept their land highly productive.

Tools. The colonial farmer worked mostly with hand tools, including an ax, hoe, scythe, sickle, and spade. He also had a *mattock*, a kind of pickax with flat blades. The farmer used his mattock to break up soil or cut roots. These tools were not much better than the sharpened sticks used by the Indians. Some farmers had a homemade wooden plow. It was so heavy that four horses or oxen were required to pull it. Sometimes farmers used tools called harrows and drags, fitted with iron teeth, to break up the soil or prepare seedbeds.

Crops. In spite of wasteful methods and poor tools, the colonial farmer was as prosperous as any farmer of his day, anywhere in the world. Even in New England, with its rocky land and short growing season, a farmer

Great Supplies of Lumber were produced by all the colonies. The timber was used in building homes and ships, and in making millions of barrels for colonial trade and industry.

"Colonel Philip Skene's sawmill and blockhouse, Fort Ann, N.Y." from a sketch by Thomas Anburey. Library of Congress

was well-off. He produced enough vegetables, grain, and meat to feed his family, and usually had extra crops for sale.

Corn was the most important crop of early colonial times. The Indians showed the first settlers how to plant and cultivate it, and how to grind the kernels to make corn meal. Farmers in all the colonies raised corn. As colonial farming developed, wheat replaced corn as the chief grain. But farmers continued to raise large crops of corn to feed their livestock.

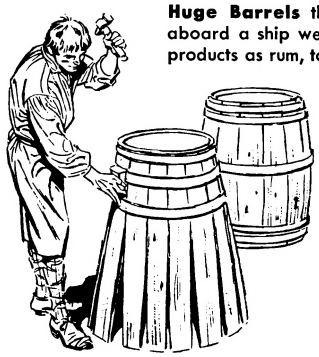
Wheat was the most valuable crop of the Middle Colonies. There, a farmer had the advantage of excellent soil and a highly favorable climate. The Middle Colonies exported so much wheat and wheat flour that they became known as the "bread colonies." These colonies also exported large quantities of beef and pork to Europe and the West Indies.

Many Maryland and Virginia farmers raised food crops, but specialized in growing tobacco. Most of the tobacco was exported to England and sold for a high price until about 1760. After tobacco prices fell, some planters raised corn or wheat instead. Maryland and Virginia had many mills that ground grain. Much flour and meal were shipped to the Northern Colonies, southern Europe, and the West Indies.

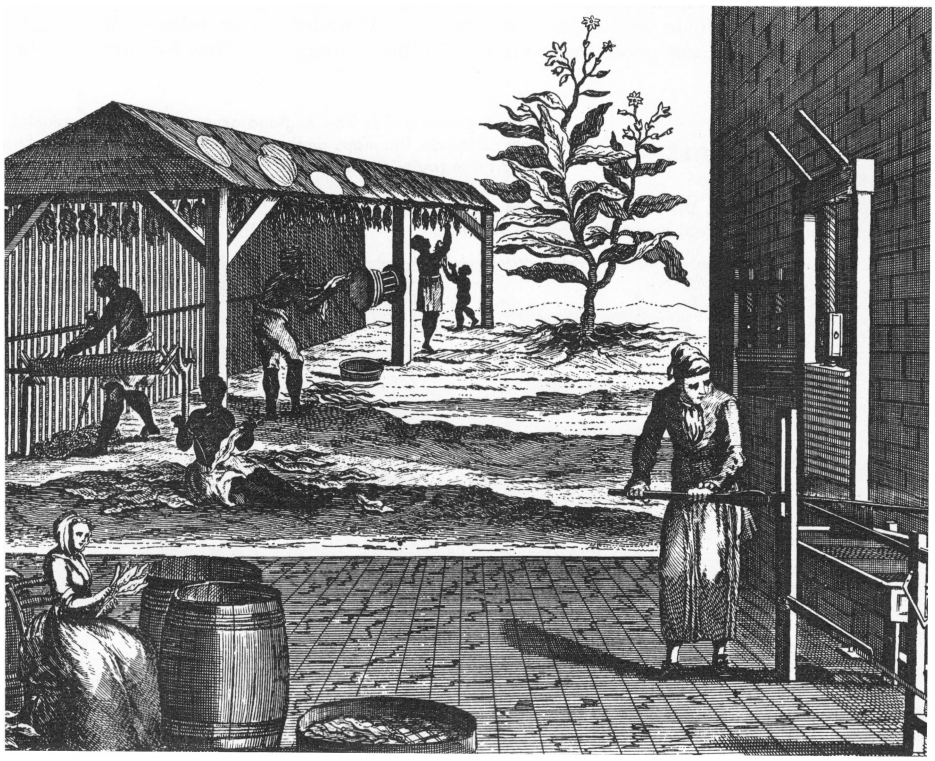
The farmers of Georgia and South Carolina developed two important crops—rice and indigo. About 1724, the South Carolina rice growers introduced irrigation systems, which increased the size of their crops. The indigo plant was the chief source of a blue dye. European textile industries used great amounts of the dye.

The Southern Colonies grew some cotton, but this crop did not become important until after the Revolutionary War. Some farmers in Pennsylvania and Virginia began to raise flax and hemp about 1750. These products were used in making clothing and rope. They

Huge Barrels that could easily be rolled aboard a ship were used for exporting such products as rum, tobacco, or naval stores.



Making Barrels and Casks for colonial trade required the skills of men called coopers.



Processing Tobacco in Virginia was illustrated by this picture which appeared in a London magazine of 1750. Most colonial tobacco was exported to English merchants.

"Tobacco Manufactory" from the *Universal Magazine*, London, Huntington Library, San Marino, Calif.

became especially important during the war, when most manufactured goods could not be imported.

Timber from all the colonies was used to produce valuable lumber and *naval stores*. In colonial times, naval stores consisted mainly of pitch and tar. These products were vital in building or repairing wooden sailing ships.

Trade and Industry

Colonial trade centered around the exchange of raw materials for European goods. English merchants were the chief customers of the colonists, and English manufactured goods were the settlers' main imports.

Trade of the colonists was strongly influenced by England's economic system, called *mercantilism*. Under this system, the English government protected the nation's industries against competition from the industries of other countries. A basic principle of mercantilism was government control of colonial trade. Parliament tried to strengthen that control by passing a series of laws called the *Navigation Acts*. Some of these laws required the colonists to trade almost entirely with merchants in England or in other English colonies, and to use English ships. Other laws tried to force the colonists to produce chiefly goods that would benefit English industries. The laws encouraged exports of iron, tobacco, and naval stores, which were greatly needed in England. The laws also prohibited the export of certain colonial farm products to England. The English feared these products would compete with English farm products. See MERCANTILISM; NAVIGATION ACT.

The colonists got around the restrictions by developing trade routes that linked colonial ports with southern Europe, the West Indies, and Africa. These three-cornered routes became known as the "triangular trade routes." On one of the routes, the colonists shipped fish, grain, lumber, and meat to southern Europe. There, the products were exchanged for fruit and wine. These were carried to England and traded for manufactured goods that went back to the colonies.

On another triangular route, American food products and lumber were traded in the West Indies for fruit, molasses, and sugar. These were taken to England and exchanged for manufactured goods, which went to America. Another route involved trading in rum and slaves. Rum, made in New England, was exchanged in Africa for Negro slaves. The slaves were exchanged in the West Indies for molasses, which went to New England to be used in making rum.

Fishing and Whaling became major industries in New England for two important reasons. First, the rocky New England land was not suitable for raising large crops. Second, New England ports were within easy sailing distance of the finest fishing and whaling waters of North America. These Atlantic coastal waters included the famous fishing area of the Grand Banks, off Newfoundland.

The principal colonial fishing centers were Boston, Gloucester, Marblehead, and Salem. The catches included cod, halibut, herring, and mackerel. Each year, thousands of tons of fish were salted and dried for export. The chief markets for the better grades of fish were in southern Europe. The poorer grades were generally sold in the West Indies to be used as food for the slaves who worked on sugar plantations.

Nantucket, New Bedford, and Provincetown became important whaling centers. Whales were valuable for their oil, used as fuel in lamps; and for whalebone, used as a stiffening material in women's clothing. For details of the early whaling industry, see WHALE.

Lumbering and Shipbuilding. From the time of the first settlements, lumbering was an important activity in all the colonies. Lumber products ranked among the chief exports of the colonists. The first export from Jamestown consisted of a cargo of clapboard and other building materials shipped to England in 1608.

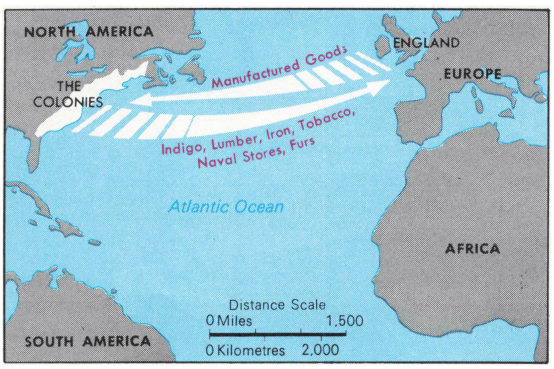
The colonists used much lumber in building houses, riverboats, and seagoing vessels. Many wood products played an important part in other colonial industries. For example, millions of staves were used to make barrels, casks, and hogsheads for shipping fish, indigo, rice, tobacco, and whale oil.

New England was the center of the shipbuilding in-

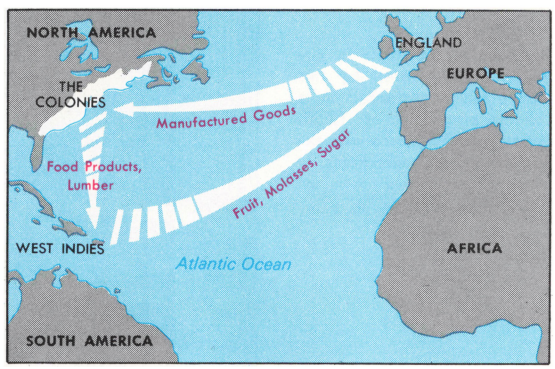
COLONIAL TRADE ROUTES

Manufactured goods from England accounted for most colonial imports. Exports consisted mostly of raw materials. The maps on these pages include the famous "triangular trade routes." The colonists used these routes to get around English laws that were designed to control colonial trade.

Ships Sailing Directly to England carried colonial products that were in great demand by English industries.



A Major Triangular Route included the West Indies. Goods traded there for colonial products were then taken to England.



dustry, largely because of the demand there for fishing boats and merchant ships. The New England forests provided good shipbuilding timber, including cedar, maple, oak, and white pine. Virginia and the Carolinas also became important in the shipbuilding industry. Their live oak trees provided excellent ship timber.

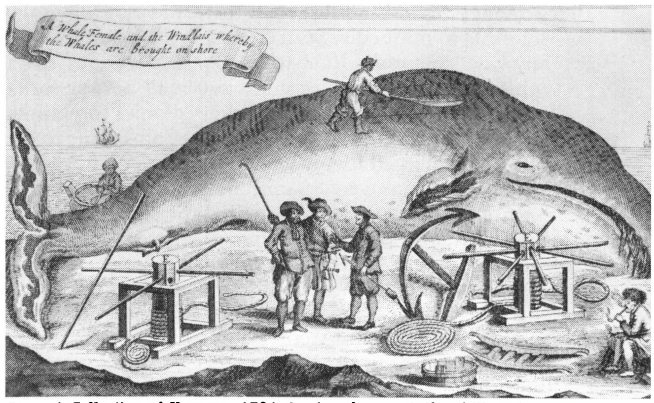
The English encouraged colonial shipbuilding because their own best timber had been used up. By the end of the colonial period, about a third of England's merchant ships were being made in America.

Ironmaking. Iron ore, the most important metal found by the settlers, was mined in most of the colonies. The colonists obtained charcoal, the chief fuel used to smelt iron ore, from their large supplies of hardwoods. The ore deposits and fuel supplies made it fairly easy to develop ironmaking industries.

The first colonial blast furnace began operating about 1621 at Falling Creek, Virginia. The first successful ironworks was built 10 miles (16 kilometers) north of Boston in 1646. The site is now Saugus, Mass. By 1770, Hunter's ironworks at Falmouth, Virginia, was manufacturing 1½ short tons (1.4 metric tons) of pig iron daily. Colonial ironworks were producing about a seventh of the world's iron by 1775.

The colonies exported much iron to England in the form of iron bars. But the colonists themselves provided the most important market of the ironmaking industry. Every colonial village or large farm had a blacksmith shop where smiths hammered out iron nails, axes, hoes, and other farm tools. Large ironworks also manufactured these products. Other iron products included cooking pots, kettles, wire, and materials used in making or repairing metal parts of carriages and wagons.

Other Industries. Many industries developed because communities needed certain products or services. Almost as soon as a colonial village was established, someone set up a grist mill to grind grain into flour or meal. Next, perhaps, a blacksmith built a shop to make or repair farm tools. As the community grew, it needed coopers to make barrels. Other industries that developed as the result of community needs included brewing, brickmaking, glassmaking, papermaking, ropemaking, and tanning.



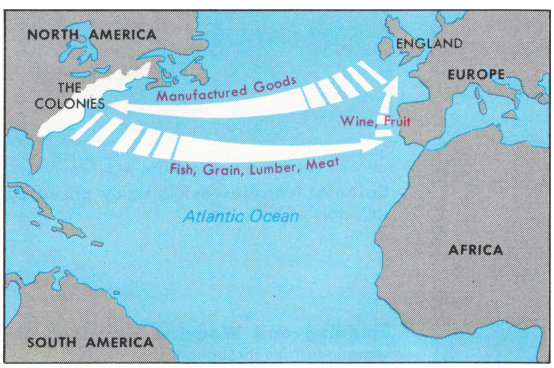
From *A Collection of Voyages*, 1704, by Awnsham and Churchill. Folger Shakespeare Library, Washington, D.C.

Colonial Whaling developed as an industry in the 1700's. But early New England settlers got valuable products, including oil for lamps, from stranded whales that they hauled ashore.

Charles Town, pictured about 1739, was the busiest seaport and richest city of the Southern Colonies. The city's wealth was based chiefly on large exports of rice, indigo, and deerskins.

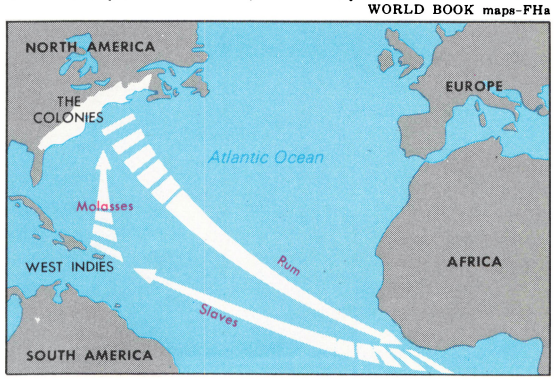
New York Public Library, I. N. Phelps Stokes Collection

An Important Triangular Route was sailed by ships carrying goods exchanged in southern Europe to ports in England.



Ships of Colonial Slave Traders sailed a route that linked West Africa, the West Indies, and home ports in the colonies.

WORLD BOOK maps-FHa



Money. The English government did not allow the colonists to mint coins. But Massachusetts built a mint anyway, and from 1652 to 1683 made various silver coins, including pine-tree shillings (see PINE-TREE SHILLING). Massachusetts and the other colonies sometimes were permitted to issue paper money. Coins came to the colonies chiefly through trade with the West Indies. Most of the coins were Spanish money, made of gold or silver. Colonial merchants weighed the coins on special scales, because customers frequently clipped or shaved the edges to get the precious metal.

The early colonists generally traded goods with each other to get the things they wanted. Sometimes furs and Indian wampum were used as part of this system of *barter* (see BARTER; WAMPUM). Certain crops often took the place of money in the colonies. Southerners used tobacco, and northerners used grain or cattle. People in Maryland and Virginia sometimes used tobacco notes. These notes resembled paper money, and their value was established by tobacco stored in warehouses. See MONEY (Money in the Colonies).

Crafts

During the early colonial period, most of the settlers made their own furniture and household articles. Wealthy colonists generally imported their furnishings from England. Later, skilled colonial craftsmen made many products of wood, iron, silver, pewter, glass, or leather. Some craftsmen copied European styles, but others developed a special American style. Examples of their work may be seen today in many museums.

Most craftsmen had shops in the cities or towns. In the Northern Colonies, some traveled from one community to another. Many customers supplied the raw materials used by a craftsman. In the south, many indentured servants were skilled craftsmen. After serving their period of indenture, many craftsmen set up their own shops.

Furniture. Most early colonial chairs, tables, beds, and chests were bulky and heavy. But the cabinetmakers improved their designs, and the furniture became lighter and more graceful. The styles that were developed to please various colonial tastes are described in FURNITURE (American Furniture).

Ironwork. Many articles made of iron by colonial blacksmiths are prized today as examples of fine craftsmanship. They include hinges, kettles, latches, locks, and weather vanes. A blacksmith was an important member of almost every community because he made and repaired tools and many other articles.

Silverware. The work of the silversmith was almost as important as that of the blacksmith. His customers considered silverware an investment because the metal itself had a high value. Valuable silver pieces included candlesticks, platters, bowls, coffee and tea pots, saltcellars, and sets of tableware.

Almost every colonial town had a silversmith, but the main silversmithing centers were Boston, Philadelphia, and New York City. Three noted silversmiths were Bostonians—John Coney, John Hull, and Paul Revere.

Pewter was used in most colonial households in some form because it was cheaper than silver. Pewterware resembles silverware, and pewterers made the same kind of articles as silversmiths. See PEWTER.

Glass. The first successful American glass factory was established in Salem County, New Jersey, in 1739. Another began operating in Manheim, Pennsylvania, in 1765. These factories produced bottles, window panes, and much fine table glass that were sold throughout the colonies. See GLASS (Early American Glass).

Other Crafts. Craftsmen who worked with leather used hides that had either been imported or tanned in the colonies. Most of these craftsmen were saddlers and harness makers. They also made boots and shoes.

Gunsmiths developed their craft in all the colonies. The gunsmiths of Pennsylvania and western Virginia developed the "long rifle" used by many Revolutionary soldiers. Some colonial rifles were beautifully carved and inlaid with silver.

Colonial Williamsburg

Spinning and Weaving were important home industries throughout the colonies.

Needlework picture by Dorothy Cotton. Henry Francis du Pont Winterthur Museum, Winterthur, Del.

Colonial Needlework is highly prized by collectors of antiques.

Colonial Williamsburg

Made by John Coney. Museum of Fine Arts, Boston, Gift of Mrs. J. R. Churchill

Silversmithing was a leading craft in the colonies. Most towns had a silversmith, *left*, who made beautiful silver pieces, such as the sugar bowl, *above*.

Walter H. Miller

Glassmaking, *left*, was slow in developing as a colonial craft. The first successful factory opened about 1739.

Stiegel Glass, named for Henry William Stiegel, a famous colonial glassmaker, is considered by some experts to be the most beautiful of all glassware. Stiegel applied patterns to his glass by molding, enameling, and engraving.

Sugar bowl and enameled tumblers by Henry William Stiegel. Corning Museum of Glass, Corning, N.Y.

Museum of Fine Arts, Boston, William E. Nickerson Fund

Furniture made by colonial cabinetmakers of the mid-1700's is noted for its graceful design. Some card tables, *left*, have needlepoint tops.

Pewterware, such as an engraved tankard, *right*, could be found in most colonial households. It was handsome and less expensive than silverware.

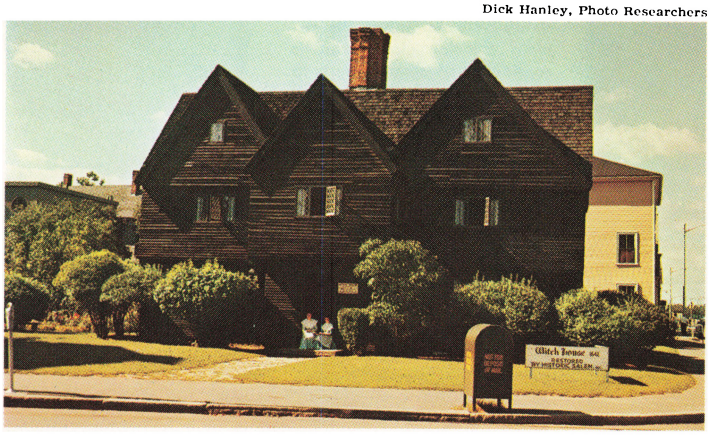
Pewter tankard made by Simon Edgell. Henry Francis du Pont Winterthur Museum, Winterthur, Del.

Jamestown Foundation

Jamestown Festival Park on the James River in Virginia

Witch House in Salem, Mass.

Dick Hanley, Photo Researchers



Plimoth Plantation in Plymouth, Mass.

Plimoth Plantation

COLONIAL LIFE IN AMERICA / *A Visitor's Guide to Colonial America*

Every year, millions of visitors tour the region that once was colonial America. Throughout the region, historic sites offer interesting glimpses of colonial life. Almost every town or city has churches or houses that date from the 1700's and a few from the 1600's. In some places, a visitor may walk through the streets of an entire colonial community that has been rebuilt. Many public buildings and museums display colonial relics in cities that were important during colonial times—Boston, Charleston, New York City, Newport, and Philadelphia. Newport has over 300 colonial buildings.

PLACES TO VISIT

Following are brief descriptions of some especially interesting places to visit. See also the Places to Visit section of the WORLD BOOK article on each state.

Amstel House, in New Castle, Del., has exhibits of colonial arts, furnishings, and crafts. The house was built in the early 1700's.

Batsto is a partially restored colonial village in southeastern New Jersey. It includes an ironmaster's house, a blacksmith shop, a general store, and a glassware exhibit.

Ephrata Cloisters, in Ephrata, Pa., is a restored religious community built by German Seventh-Day Baptists in 1732.

Farmers' Museum, near Cooperstown, N.Y., has many colonial farm tools. Nearby is the **Village Crossroads,** a typical colonial village.

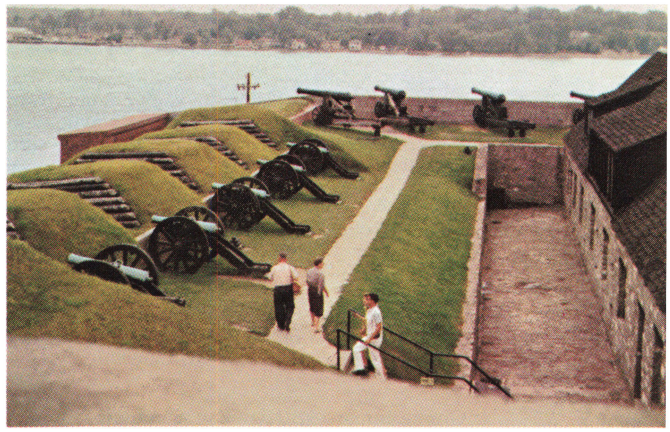
Fort Niagara, near Youngstown, N.Y., was the scene of fighting during the French and Indian Wars and the Revolutionary War. It was originally built in 1678.

Henry Francis du Pont Winterthur Museum, near Wilmington, Del., has a magnificent collection of early American furniture. Visitors must write for permission to go through this museum.

Jamestown Island, on the James River in Virginia, is the site of the first permanent English settlement in

Farmers' Museum, Cooperstown, N.Y.

Blacksmith Shop at Farmers' Museum in Cooperstown, N.Y.



DPI

Fort Niagara near Youngstown, N.Y.

Meeting House in Ephrata, Pa.

Bradley Smith, Photo Researchers

Saugus Iron Works in Saugus, Mass.

Scenic Art Color Slides

America. It is a National Park. Nearby, **Jamestown Festival Park** has reproductions of old James Fort and of the three ships that brought the first settlers to Jamestown in 1607.

Old Gaol Museum, in York, Me., was built in 1653, and is one of America's oldest buildings. It served as a *gaol* (jail) until 1860.

Old Narragansett Church, in North Kingstown, R.I., is the oldest Episcopal church in the northern United States. It was built in 1707.

Old Salem is a restored colonial village in Winston-Salem, N.C. Moravians founded the village in 1766.

Old Sturbridge Village, in Sturbridge, Mass., is a replica of a New England town in 1800.

Old Town Mill, in New London, Conn., is a colonial grain-grinding mill, built in 1650.

Plimoth Plantation, in Plymouth, Mass., is a reconstruction of the first Pilgrim settlement.

St. Mary's City, a village near Leonardtown, Md., was Maryland's first settlement, established in 1634.

Saugus Iron Works National Historic Site, in Saugus, Mass., is a reconstruction of America's first successful ironworks, built in the 1640's.

Shelburne Museum, in Shelburne, Vt., is a reconstruction of an early American village. The buildings house one of the world's most complete collections of articles used by the settlers.

Strawbery Banke, in Portsmouth, N.H., is a restoration of a colonial village, settled in 1630.

Whitehorse Tavern, in Newport, R.I., was built in 1673.

Williamsburg is a Virginia city whose colonial buildings have been restored or rebuilt. Colonial Williamsburg provides a glimpse of the buildings, gardens, furnishings, crafts, and social life of the 1700's.

Witch House, in Salem, Mass., was the home of Judge Jonathan Corwin, a judge at the witchcraft trials of the early 1690's.

JANE CARSON

Related Articles. For the history of each colony, from settlement to statehood, see the separate state articles in WORLD BOOK, such as GEORGIA (History). See also the following articles:

COLONIZATION

Dutch West India Company
Jamestown
London Company
Lost Colony
Massachusetts Bay Colony
New England, Dominion of
New England Confederation
New Netherland
New Sweden
Ohio Company (The First)
Plymouth Colony
Plymouth Company
Williamsburg

GOVERNMENT AND LAW ENFORCEMENT

Blue Laws
Ducking Stool
Flag (color pictures: Flags in American History)
House of Burgesses
Mayflower Compact
Money (Money in the Colonies)
Pillory
Stocks
Town Meeting

EDUCATION AND COMMUNICATION

American Literature (Colonial Writing)
Bay Psalm Book
Education (History)
Freedom of the Press (picture)
Hornbook
Newspaper (picture: In Colonial Days)
School (Colonial Schools)
Town Crier

BIOGRAPHIES

THE NEW ENGLAND COLONIES

Alden (John; Priscilla M.)
Andros, Sir Edmund
Bradford, William
Bradstreet, Anne D.
Brewster, William
Brown (family)
Carver, John
Cotton, John
Dudley, Thomas
Dyer, Mary
Eaton, Theophilus
Endecott, John
Faneuil, Peter
Hooker, Thomas
Hutchinson, Anne M.
Massasoit
Mather (family)
Philip, King
Randolph, Edward
Samoset
Sewall, Samuel
Shirley, William
Squanto
Standish, Miles
Uncas
Warwick, Earl of (1587)
Wentworth, Benning
White, Peregrine
Williams, Roger
Winslow, Edward
Winthrop (family)
Wise, John

THE MIDDLE COLONIES

Bradford (family)
Franklin, Benjamin
Jemison, Mary
Johnson, Sir William
Leisler, Jacob
Minuit, Peter
Pastorius, Francis D.
Penn, William
Stuyvesant, Peter
Van Rensselaer (family)
Zenger, John Peter

THE SOUTHERN COLONIES

Bacon, Nathaniel
Baltimore, Lord
Berkeley, Sir William
Byrd (family)
Dare, Virginia
Delaware, Lord
Dinwiddie, Robert
Oglethorpe, James E.
Pinckney (Elizabeth L.)
Pocahontas
Powhatan
Randolph (William)
Rolfe, John
Smith, John
Spotswood, Alexander

OTHER RELATED ARTICLES

Bacon's Rebellion
Charter Oak
Claiborne's Rebellion
Doll (Colonial Dolls)
French and Indian Wars
Georgian Architecture
Great Awakening
Indentured Servant
Indian Wars
Mayflower
Patroon System
Pennsylvania Dutch
Pilgrim
Pioneer Life in America
Plymouth Rock
Puritan
Salem (Mass.)
Shelter (Pioneer)
Shot Tower
Spinning
Thanksgiving Day
Witchcraft

Outline

I. The Thirteen Colonies
- A. Why the Colonists Came to America
- B. Early Settlements
- C. Development of the Colonies
- D. Relations With the Indians

II. Society and Government
- A. Colonial Society
- B. Government
- C. Voting Requirements
- D. Local Government
- E. Law Enforcement

III. The Home
- A. Houses
- B. Furnishings
- C. Clothing
- D. Food
- E. Health
- F. Recreation

IV. The Church and the School
- A. The Church
- B. The School

V. Travel and Communication
- A. Travel
- B. Communication

VI. Arts and Sciences
- A. Literature
- B. Painting
- C. Science

VII. Economy
- A. Farming
- B. Trade and Industry
- C. Crafts

VIII. A Visitor's Guide to Colonial America

Questions

How did the English settlers in the New World differ from the Spanish and French?

What were the three major types of English colonies?

How did most colonial boys learn a trade or profession?

What were two of the most important reasons for the survival of the Jamestown settlement?

Why were the Middle Colonies known as the "bread colonies"?

What were the five most important colonial cities of the 1700's?

How did the colonists get around the trade restrictions of the Navigation Acts?

What were the two most important crops of Georgia and South Carolina?

What were three chief reasons for discontented Europeans to migrate to the colonies?

What was the purpose of the Proclamation of 1763?

Books for Young Readers

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AMERICAN HERITAGE. *The French and Indian Wars.* American Heritage, 1962. *Jamestown: First English Colony.* 1965.

DALGLIESH, ALICE. *The Thanksgiving Story.* Scribner, 1954. *The Fourth of July Story.* 1956. *America Begins: The Story of the Finding of the New World.* Rev. ed. 1959. These books are all intended for the early elementary grades. They combine pictures with a brief text and make historical events meaningful for young children.

EDMONDS, WALTER D. *Matchlock Gun.* Dodd, 1941. Fiction. A boy fights off an Indian attack in colonial times.

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SMITH, ERIC B., and MEREDITH, ROBERT, eds. *Pilgrim Courage.* Little, Brown, 1962. The story of the early struggles of the Pilgrims, based on William Bradford's journals and on other firsthand sources.
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TUNIS, EDWIN. *Colonial Living.* World Publishing Co., 1957. The author illustrates this history of colonial America with over 200 line drawings on subjects from house construction to costumes. *Colonial Craftsmen and the Beginnings of American Industry.* 1965. This book describes and illustrates the development of about 35 important trades, showing how they were organized.

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ACHESON, PATRICIA C. *America's Colonial Heritage.* Dodd, 1957.
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COLONIAL NATIONAL HISTORICAL PARK. See NATIONAL PARK SYSTEM (table).

COLONIALISM is a term that usually refers to the rule of a group of people by a foreign power. The people and their land make up a colony. Most colonies are separated by an ocean from the ruling nation. The foreign power sends people to live in the colony, to govern it, and to use it as a source of wealth. The rulers and the people of most colonies belong to different racial groups. The rulers also have a more complex civilization and advanced technology than do the people of most colonies.

Colonialism dates back to ancient times. The Romans ruled many colonies in Europe, the Middle East, and Africa. Beginning in the A.D. 1400's, European nations built vast colonial empires in Africa, Asia, Australia, North America, and South America. The major colonial powers were France, Great Britain, The Netherlands, Portugal, and Spain. By the 1970's, most colonial empires had broken up.

Nations have sought colonies chiefly to gain economic benefits. They have wanted land and such valuable products as diamonds, gold, and spices for themselves. They also have wanted to expand their industry and trade by gaining (1) sources of raw materials, (2) markets for their goods, (3) sources of goods that could be exported to other countries, and (4) opportunities for investment. In addition, nations have practiced colonialism to increase their fame, to gain military advantages, and to spread their religion.

Some people believe that widespread colonialism still exists. They define colonialism as any form of economic, political, or social *oppression* (unjust treatment) of one group by a group of different ancestry. However, this definition is not widely accepted. Other people use the term *neocolonialism* for the indirect control they believe is exercised by developed nations over underdeveloped nations. According to these people, many underdeveloped nations depend on investment capital from developed nations. Such dependence supposedly allows the developed nations to take advantage of the underdeveloped ones. This article discusses colonialism as it is generally defined.

History of Colonialism

Ancient Colonialism. The Roman Empire was the greatest colonial empire of ancient times. Rome began its overseas expansion about 264 B.C. At its height, the empire extended from northern Britain to the Red Sea and Persian Gulf. The empire collapsed in A.D. 476.

COLONIALISM

Early European Colonialism. In the 1400's, Portugal and Spain began to send explorers in search of sea routes to India and the Far East. Moslems controlled land routes across the Middle East and so controlled trade between Asia and Europe. Europeans hoped to take over this trade. Portugal gained control of Brazil and set up trading posts in West Africa, India, and Southeast Asia. Spain gained control of part of what is now the United States, plus much of Latin America.

During the 1600's, the Dutch and the English took control of the Asian trade from the Portuguese. The Dutch gained control of the islands that became the Dutch East Indies (now Indonesia), and the English became a strong influence in India. The Dutch, English, and French also took over parts of Latin America.

The English and French moved into parts of Canada as well. The Dutch, English, and French claimed sections of what became the United States. There, the English eventually established the Thirteen Colonies. In 1624, the Dutch settled New Netherland, which included parts of what are now Connecticut, Delaware, New Jersey, and New York. The English took over New Netherland in 1664. The four French and Indian Wars between the British and the French took place in North America from 1689 to 1763. The last of these wars ended in a British victory, and Great Britain took control of most of France's North American possessions. During the late 1600's and the 1700's, large numbers of English and other European settlers made their home in North America.

Later Colonialism. The Thirteen Colonies gained independence from England in the Revolutionary War (1775-1783). Most colonies in Latin America fought for and won independence in the 1700's and early 1800's.

European colonial expansion slowed somewhat during the early and mid-1800's, though Great Britain claimed several colonies in Australia. Many people had come to believe that colonies were not worth the trouble and expense involved in managing them. However, the Industrial Revolution contributed to great colonial expansion during the late 1800's and early 1900's in Africa and Asia. There, the industrial nations sought raw materials for their factories, markets for their manufactured goods, and opportunities for investment.

Belgium, France, Germany, Great Britain, Italy, Portugal, and Spain divided almost all Africa among themselves, leaving only Ethiopia and Liberia independent. Great Britain extended its control in India and other parts of Asia. The French took over Indochina. The Dutch expanded their control in the East Indies. The United States acquired the Philippines. France, Germany, Great Britain, Spain, and the United States competed for control of the Pacific Islands.

Also in the late 1800's and early 1900's, conquests gave Japan an empire that included colonies formerly held by Western nations. The empire collapsed after Japan's defeat in World War II in 1945. Most of the colonies were returned to the Western nations.

Three factors helped bring large-scale colonialism to an end during the 1950's and 1960's. First, the European nations had been weakened by the war. In addition, many people had come to oppose colonialism as unjust. Finally, nationalist feelings and demands for self-government had been growing among most colonies in Africa and Asia. Some of these colonies gained independence peacefully. Others became independent only after fighting a war against their ruler. Portugal kept control over its African colonies until the mid-1970's, when it granted them independence. Before independence was granted, Portuguese troops fought a strong colonial resistance movement in Angola, Mozambique, and Portuguese Guinea (now Guinea-Bissau).

Colonialism Today. France, Great Britain, The Netherlands, Portugal, Spain, and other nations still have a few colonies. Britain calls its colonies *dependencies*. The United States governs a number of overseas areas, but these areas are not officially called colonies. These areas include American Samoa, Guam, and various other Pacific islands; the Panama Canal Zone; Puerto Rico; and the Virgin Islands. Critics of the Soviet Union accuse the Russians of exercising "colonial" rule over the smaller countries of Eastern Europe.

Colonial Policies

Many colonial rulers forced their way of life on the people of their colonies. They did so partly because they considered the people's culture inferior to their own. Many rulers tried to convert the colonial people to their own religion. They also made their language the official language of the colonies. They often tried to replace the native culture with their own culture. But the colonial powers were chiefly concerned with establishing economic and political policies that would be most beneficial to themselves.

Economic Policies. Ruling nations sought economic benefits from their colonies. In ancient times, such nations increased their wealth by forcing conquered peoples to work for them and to make payments in return for protection. These payments were called *tribute*.

From the 1500's to the 1700's, an economic system called *mercantilism* existed in Europe. Under this system, the European powers molded the economy of their colonies to fit their own trading needs. For example, England passed a series of laws during the 1600's and 1700's to strengthen its control over the economy of the Thirteen Colonies. Some of these laws required the American colonists to trade almost entirely with merchants in Great Britain or in other British colonies, and to use British ships. Other laws limited colonial manufacturing because the British wanted the colonists to depend largely on Great Britain for manufactured goods. To encourage the Americans to export goods needed by Great Britain, the British granted certain trading privileges to such exports. Other European nations handled trade with their colonies in a similar way.

Slavery was an important part of colonial economic policies during the mercantilist period. In the South American colonies, the Europeans first forced the native Indians to work on the plantations that produced cotton and other raw materials. Later, they imported slaves from Africa.

Most countries in North and South America abolished slavery during the 1800's. About the mid-1800's, the British decided that mercantilism had hurt some of their industries. As a result, Great Britain gradually adopted a system of *free trade*, which ended controls on colonial trade. By 1870, most other colonial powers also had liberalized their trading practices.

Free trade did not prevent the expansion of colonialism in Africa and Asia. Colonies still could provide raw materials and markets for European goods. Also, European bankers and industrialists made profits by investing in the factories, mines, plantations, and railroads being created in so-called "backward" regions. The European nations established colonies in these regions partly to protect such investments.

By the early 1900's, most colonial powers had again adopted a system of economic controls. However, these controls were not nearly so restrictive as those of the mercantilist period. Today, most colonies have close economic ties with the nation that rules them.

Political Policies used in governing colonies varied widely. Some ruling nations made their colonies completely dependent. Others allowed them some self-government. The colonial rule of Belgium, France, Great Britain, and Portugal in Africa and Asia shows how political policies differed.

Belgium's chief colony was the Belgian Congo (now Zaire) in Africa. Belgium gained control of the Congo in 1885 and ruled it entirely from Brussels, the Belgian capital. The Belgians gave the Congolese no share in the government of the colony. Uprisings occurred in the Congo in 1959, and Belgium granted independence in 1960.

Likewise, the French governed their colonies completely from Paris. The people of the upper class in the colonies were expected to become like the French —culturally, economically, and politically. Two colonial revolts showed the unwillingness of the French to accept the end of colonialism. A revolt began in Indochina in 1946 and did not end until 1954, when the French withdrew after suffering heavy losses. Also in 1954, a revolution broke out in Algeria, a French territory in Africa.

The fighting there continued until 1962, when Algeria became independent. France has peacefully granted independence to most of its other possessions.

Great Britain at first governed its colonies largely through British officials. But through the years, the British gave the colonial people a growing role in local courts, legislative councils, and public service. For example, the people of India played an increasing part in their government from 1918 to 1939, the period between World War I and World War II. India gained independence in 1947. Its successful change from colony to nation led Britain to grant independence to other colonies.

Portugal claimed that its colonies were self-governing. However, Portugal determined most major legislation and administrative policy for the overseas provinces.

Effects of Colonialism

Colonialism has had both good and bad effects on colonies and ruling nations. For example, colonial powers have often exploited their colonies economically. But colonialism did bring some economic development. It also raised the living standards of many colonial peoples by introducing Western agricultural, industrial, and medical techniques. On the other hand, the population increases that resulted from higher living standards may sometimes have kept those standards from improving further—or even lowered them.

Colonial rule brought many people under the political control of Europeans. But it also ended local wars in many areas and united those areas under one nation. Ruling powers set up modern educational systems and introduced democratic forms of government. Yet in many cases, the rulers gave the colonial people too little training to prepare them for independence. Many rulers also tried to force their culture on colonial people. But many historians believe that knowledge of Western culture benefited colonial peoples in various ways.

Colonialism brought wealth and power to the ruling nations. But it also led to nationalist feelings and resistance movements among colonial peoples—and thus helped bring about its own end. LEWIS HENRY GANN

Related Articles. See the *History* section of the articles on countries mentioned in this article. See also the following articles:

Africa (History)
Asia (History)
Canada, History of
Colonial Life in America
Colony
Commonwealth of Nations
Condominium
Crown Colony
East India Company
Enclave
Exploration and Discovery
Governor General
Imperialism
Latin America (Colonization)
Mandated Territory
Mercantilism
Minority Group (How a Group Becomes a Minority)
Protectorate
Roman Empire
Territory
Trust Territory
United States, History of
World, History of

See also *Colonialism* in the RESEARCH GUIDE/INDEX, Volume 22, for a *Reading and Study Guide.*

COLONNADE. See ARCHITECTURE (Greek).

COLONY. See ANIMAL (Animal Homes; Animals That Live Together); ANT (The Ant Colony); BEE (The Honeybee Colony); BEAVER.

COLONY is a settlement established by people outside their native land, and ruled by the mother country. Nations establish colonies to find more room in which people can live, to increase trade by providing a market for manufactured goods, to gain sources of raw materials, to secure military advantages, and to increase the prestige of the mother country.

Climate has often decided how a colony develops. Temperate lands have attracted large numbers of colonists who have pushed out the inhabitants of the region. This occurred in the settlement of North America, where the new settlers drove the Indians farther and farther westward. Only a few colonists have left their native lands to settle in areas where the climate was either very hot or very cold. These few, instead of pushing out the inhabitants of the region, took control of the colonized territory, as the Belgians did in the Belgian Congo.

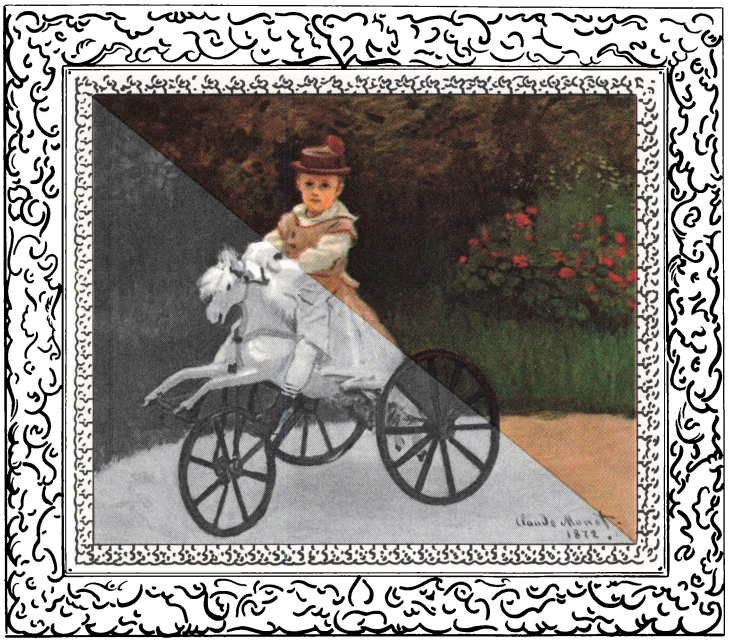
Some colonies eventually become independent of the mother country. This happened when America broke away from England and became the United States. Canada, Australia, New Zealand, and India once were British colonies, but now are independent members of the British Commonwealth. Many former colonies of nations defeated in World Wars I and II became United Nations trust territories. Most of them are now self-governing. WILLIAM T. R. FOX

See also COLONIALISM with its list of *Related Articles.*

COLONY, PENAL. See PENAL COLONY.

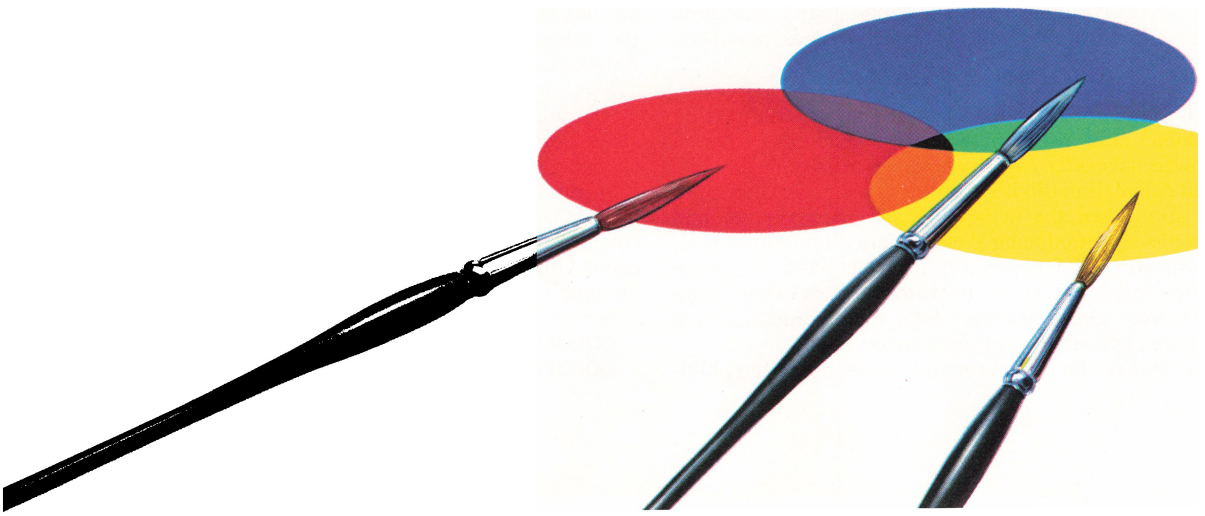
COLOPHON. See BOOK (Parts of a Book).

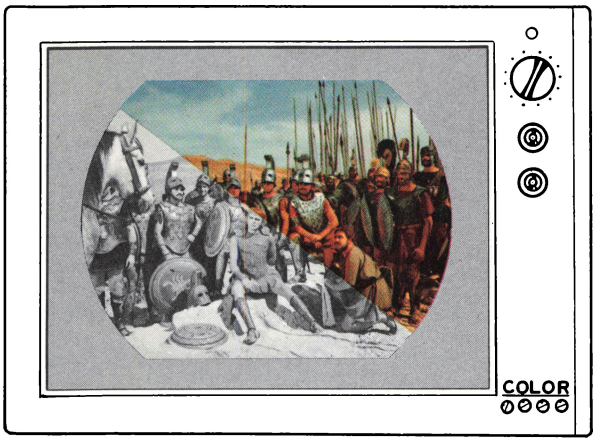
COLOR



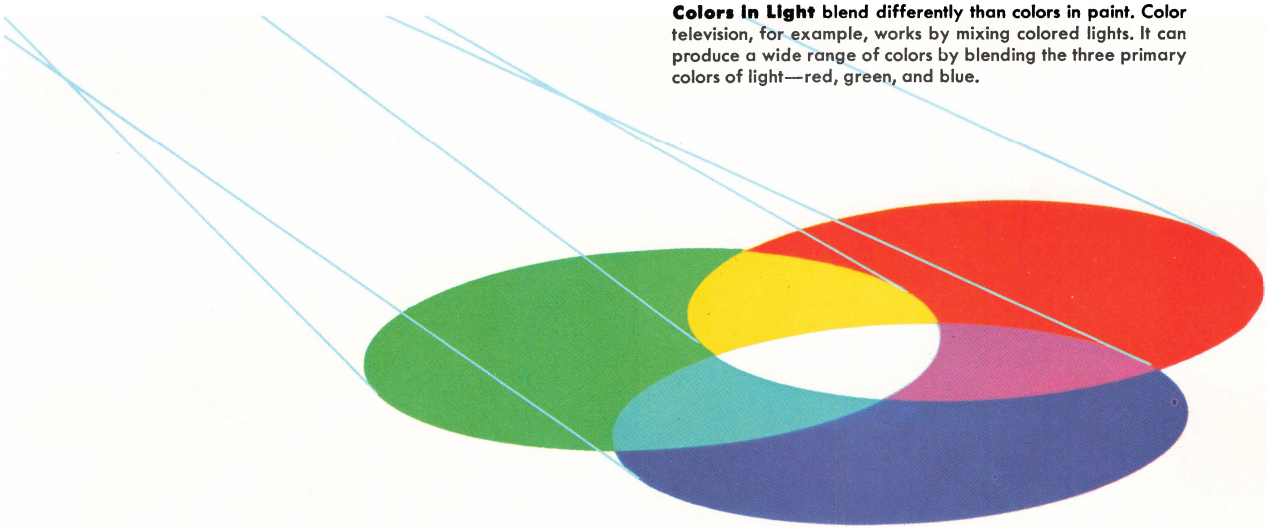
Jean on a Wooden Horse, by Claude Monet, courtesy of Mr. Nathan Cummings, Chicago

Colors in Paint capture a wide variety of natural colors, and can be created by mixing only a few paints. The artist can make any color by blending the three primary colors of paint—red, yellow, and blue.





Colors in Light blend differently than colors in paint. Color television, for example, works by mixing colored lights. It can produce a wide range of colors by blending the three primary colors of light—red, green, and blue.



Illustrated by George V. Kelvin for WORLD BOOK

COLOR surrounds us everywhere. We see it in the sky, in the oceans, in the rocks, and in all plants and animals. Color adds beauty to our clothing and food. It makes our homes, schools, and offices attractive. We see it in paintings and photographs, in books and magazines, and in motion pictures and television shows. Advertisements and posters attract our attention with bright colors. Signs in yellow and black warn us of danger. Safety equipment is painted green, and fire trucks are red.

We use the names of colors in many common sayings. A person *sees red* when he loses his temper, or becomes *green with envy* at someone else's luck. He may *feel blue* (sad) because someone has *called him yellow* (a coward). But *once in a blue moon* everything goes all right and he has a *red-letter day*.

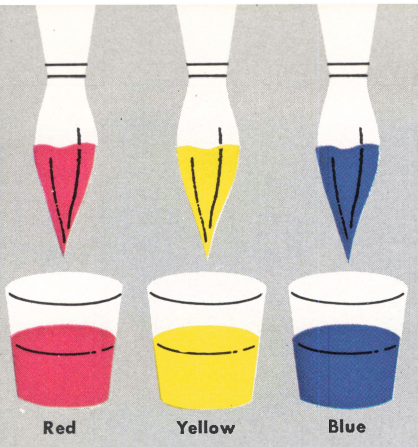
Everything in the world has color. Our eyes see grass as green, an apple as red, and a beach as yellow-brown. We take these colors for granted, but we cannot prove that they exist. In fact, we know that dogs and many other animals cannot see colors. Still other animals, such as bees, see colors we do not see. All we know is that our eyes see color when light strikes them.

To learn about color, scientists have explored the nature of light. They know that white light, such as sunlight, can be broken up into the colors of the rainbow. They also know that these colors can be combined again to form white light.

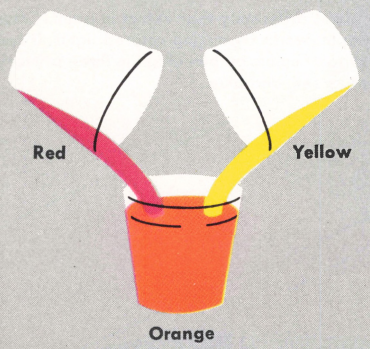
Scientists have discovered many ways in which colors in light differ from the colors of a house, an apple, or an automobile. They believe that there are two ways to examine color. One way is to study the qualities of various colors as they appear in such things as paint. The other method is to study the way we see color.

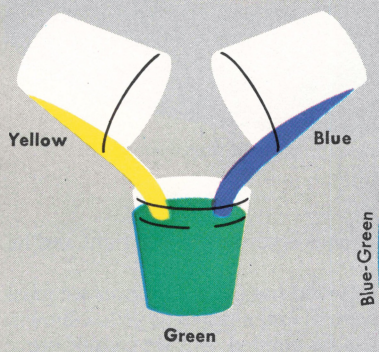
Ralph M. Evans, contributor of this article, is former Director of the Photographic Technology Division, Eastman Kodak Company. Faber Birren, the critical reviewer, is an industrial consultant on color. Artwork and photography by Arnold Ryan Chalfant & Associates except where noted.

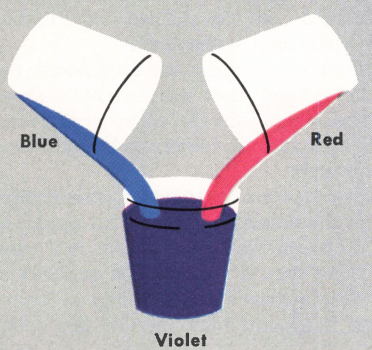
COLOR IN PAINT



Primary and Secondary Colors. A painter mixes pairs of the primary colors red, yellow, and blue to make the secondary colors orange, green, and violet, as shown *below*.







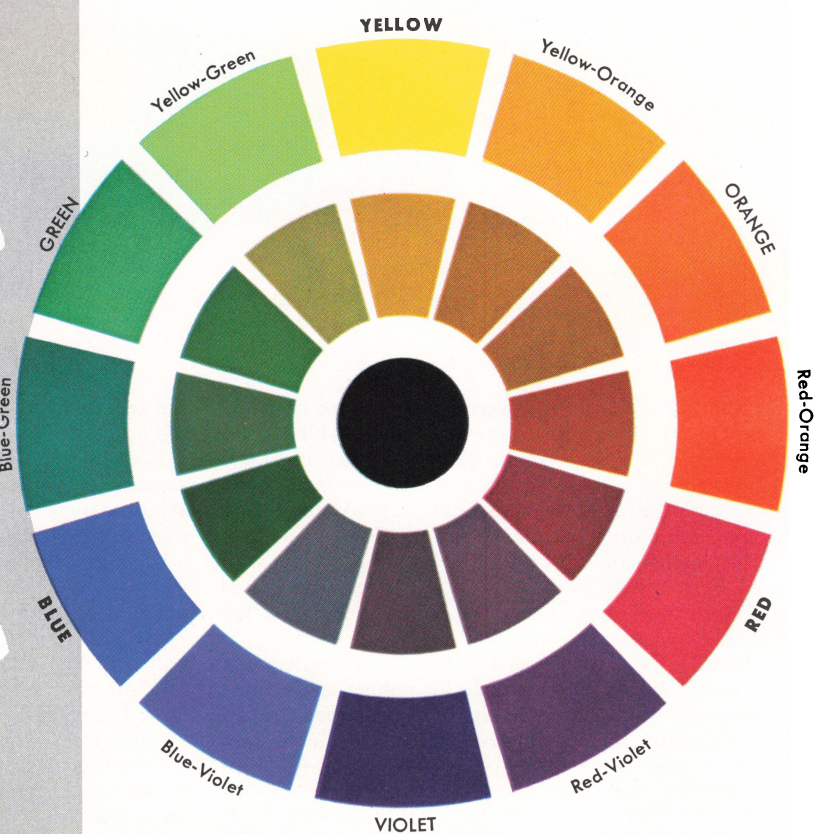
An artist can paint a sunset by starting with only three colors. He needs only red, yellow, and blue paint. He can mix these colors together to make others. For example, he can make orange for the glow of the sun by mixing red and yellow. He can make green for the grass by combining yellow and blue. And he can make violet for the shadows by mixing blue and red. The painter can go on to mix as many other colors as he needs. He simply combines his first three colors (red, yellow, and blue) with his three new ones (orange, green, and violet). He can make brown by mixing the orange with blue, and light yellow-green by blending yellow and green. He can make gray by mixing red and green.

Mixing colored light produces different results than mixing the same colors in paints. Blue and yellow paints mix to make green, but blue and yellow lights mix to make white. This and other information about colored light is explained in the section *Color in Light*.

The Color Wheel. We can arrange the painter's colors in a circle like the face of a clock to show how they are related. We start with red, yellow, and blue. These are called the *primary colors in paint* because we can use them to make the widest range of other colors. We put yellow at 12 o'clock, red at 4 o'clock, and blue at 8 o'clock.

Next, we put orange, violet, and green at 2 o'clock, 6 o'clock, and 10 o'clock on the circle. These colors are called *secondary* or *binary colors* because they are made by mixing the primary colors.

THE COLOR WHEEL



The outer circle shows the primary and secondary colors, separated by six intermediate colors. The inner circle shows darker colors obtained by mixing two colors that lie opposite each other in the outer circle.

Our clock face has spaces for six more colors. These colors are yellow-orange, red-orange, red-violet, blue-violet, blue-green, and yellow-green. These six colors are called *intermediate colors* because they lie between the primary and secondary colors.

Artists also speak of *tertiary colors*. These are soft colors formed by mixing the secondary colors together.

Any two colors directly opposite each other in the circle produce a black or dark gray when mixed together in equal parts. Such colors are called *complementary colors in paint*. When mixed together in unequal parts, complementary colors darken each other. For example, a little blue added to orange creates brown, and a little orange added to blue produces a darker blue.

The circle of paints can be expanded into a full *color wheel* such as the one shown here. The color wheel is one of the best ways to show how paint colors are related to each other. Some color wheels have only 10 colors, and others have as many as 100.

The Color Triangle. Two important paint colors, black and white, do not appear anywhere on the color wheel. We can see how black and white fit into the world of color by using a *color triangle*. A color triangle has a color at one angle, black at another, and white at the third. If a color from the color wheel, such as red, is mixed with white, the result is a *tint*—in this case, pink. If we mix red with black, the result is a *shade*—in this case, maroon. And if we mix red with both black and white, the result is a *tone*—in this case, rose.

Color Harmony is the use of combinations of colors to produce a pleasing effect. A woman may use color harmony when she selects the color of a hat to wear with a new dress. Interior decorators plan color schemes for the rooms of a home according to the principles of color harmony. Many persons use a color triangle or a color wheel to find attractive combinations of colors.

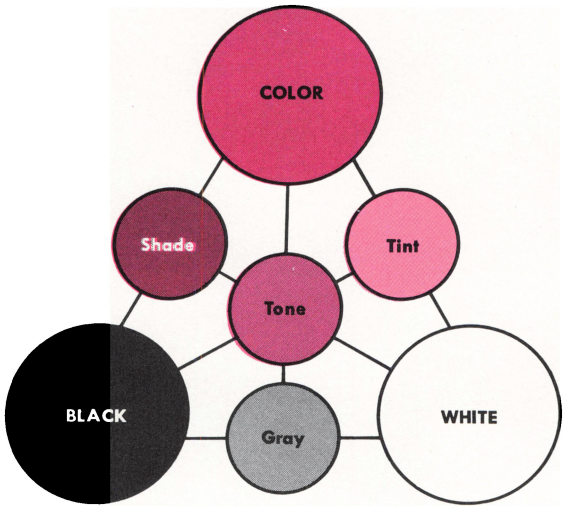
In a color triangle, the colors in any straight line form pleasing combinations. A pure color harmonizes with tints and white, with shades and black, or with tones and gray. A tint and a tone blend with black, and a shade and a tone go well with white. Groups of tints, shades, or tones also harmonize well.

In the color wheel, complementary colors, such as red and green, go well together. Such combinations often appear in nature, as in blue or violet flowers with orange or yellow centers. A color also goes well with the colors next to its complementary, such as red with blue-green and yellow-green. These are called *near complementary* or *split complementary colors*. Any three equally spaced colors, called *triads*, go well together, as in yellow-orange, red-violet, and blue-green.

Color harmony may also be achieved with *adjacent colors*. These colors lie next to each other on the color wheel. A color scheme called a *mutual complement* combines five adjacent colors (such as blue-green, green, yellow-green, yellow, and yellow-orange) with the complementary of the middle one (red-violet). A *double complement* combines two sets of complementaries, such as yellow-green and red-violet with yellow-orange and blue-violet.

There are no set rules of color harmony, because too many factors must be considered. If one color covers a large area and another near it covers only a tiny space, problems of harmony do not arise. The problems vary if one color covers a shiny area and the other covers a rough one. Any two colors could probably be made to blend harmoniously. For additional information on color harmony, see INTERIOR DECORATION (Using Color; Color and Light; pictures).

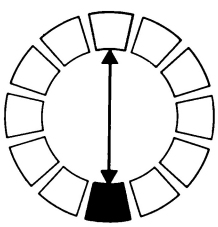
THE COLOR TRIANGLE



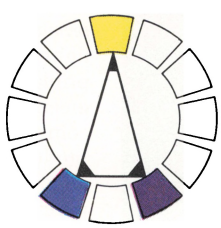
A color from the color wheel can be mixed with white to make a *tint*, or with black to make a *shade*. The color can also be blended with gray (a mixture of black and white) to produce a *tone*.

COLOR HARMONY

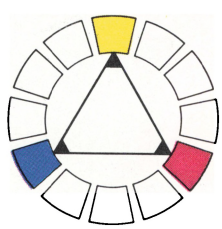
The diagrams *below* show how three kinds of harmonizing colors can be found by connecting various positions on the color wheel.



Complementary Colors, such as yellow and violet, lie directly opposite each other on the color wheel.

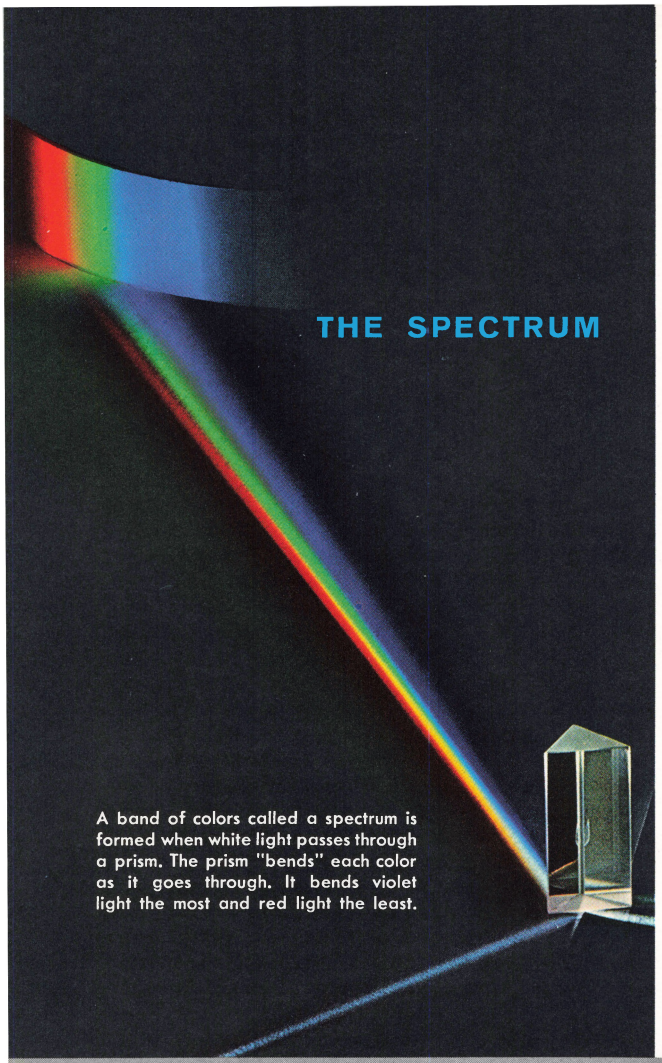


Near-Complementary Colors, such as yellow and red-violet, or yellow and blue-violet, lie nearly opposite one another.



A Triad consists of three colors spaced an equal distance apart, such as the primary colors yellow, red, and blue.

COLOR IN LIGHT



A band of colors called a spectrum is formed when white light passes through a prism. The prism "bends" each color as it goes through. It bends violet light the most and red light the least.

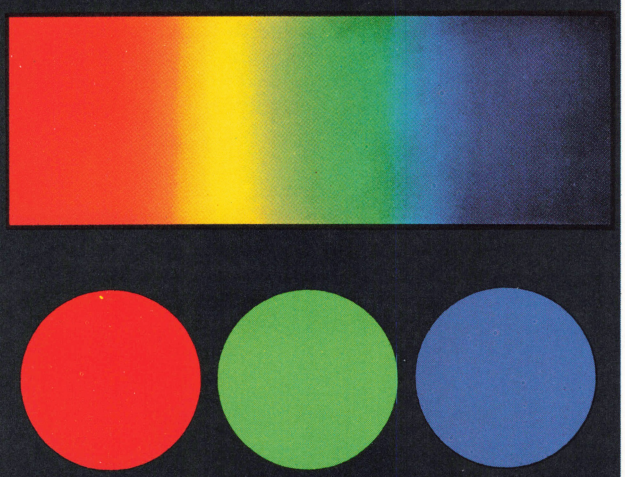
Light travels in waves, just as radio signals and X rays do. Light waves are the only ones we can see. Scientists can measure the lengths of these waves. By examining colored lights, they have discovered that each has its own wavelength. Violet light has the shortest waves we can see—67,000 waves per inch (26,400 waves per centimeter). Red light has the longest visible waves. But even these waves are short—33,000 per inch (13,000 per centimeter). See LIGHT.

A narrow beam of white light spreads out into a beautiful band of colors when it passes through a transparent prism. This band contains the colors of the rainbow and is called the *spectrum*. The colors of the spectrum blend into each other, running from violet through blue, green, and yellow to red. The spectrum does not contain a true red—one that is neither yellowish nor bluish. Nor does it form a full circle of colors. The spectrum has no colors between red and violet, as the color wheel does.

By using a prism to form the spectrum, we learn that white light is a mixture of many colored lights. Thus, we can make colored lights from white light, and we also can make white light by mixing colored lights.

We can recombine the colors of the spectrum to form white light if we put a second prism close to the first one and use it to "collect" the colors. But suppose we put a mask over the first prism, letting only a tiny part of the spectrum come through. The light will have only one color. We cannot beam this *monochromatic* light through a second prism and divide it still further. In other words, we can divide white light to make colored lights, but we cannot divide narrow regions of the spectrum to make other colors.

PRIMARY COLORS IN LIGHT



Primary colors of light—red, green, and blue—can be mixed together to make white light. Each primary color may be thought of as a blend of the colors in one-third of the spectrum.

We can form all colored lights by blending groups of colors from the spectrum. We blend the colors by passing them through a prism. If we take about a third of the spectrum at the red end, and blend its colors, the resulting light will be red. If we take about a third of the spectrum at the violet end, the blended light will be blue. And if we take the middle third of the spectrum, its colors will blend to form green.

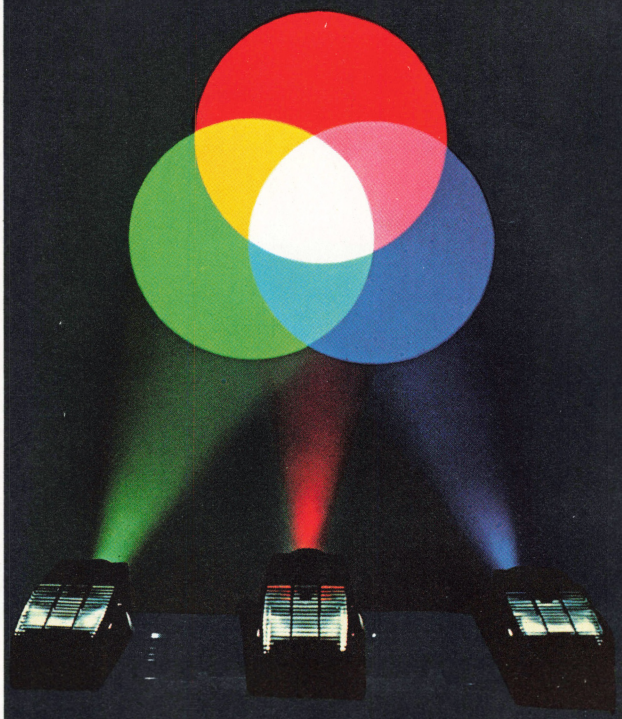
These three colors—red, blue, and green—are the *primary colors in light*. The red and blue primaries of light are not exactly the same colors as the red and blue primaries of paint. In light, the blue primary is less green and the red primary is more orange. When we combine the three light primaries in equal parts, we produce white light, just as though we had combined all the colors of the spectrum. Many scientists define pure white light as a mixture of equal amounts of red, blue, and green light. These primary colors are used in creating color television (see TELEVISION [How Television Works; pictures]).

COLOR BY ADDITION OR SUBTRACTION

The principle of forming colors by combining parts of the spectrum is called *additive color mixture* or *color by addition*. It is one of two basic ways to mix colors, and can be used only with colors in light. The other basic way of mixing colors involves subtracting parts of the spectrum from white light. It is called *subtractive color mixture* or *color by subtraction*. It forms the basis for almost all present-day color photography (see PHOTOGRAPHY [Color Photography]).

When the spectrum falls on a colored surface, rather than a white one, the results are quite different. Instead of seeing the whole spectrum, we see only some parts of it. For example, red paper reflects most of the light waves at the red end of the spectrum. But it *absorbs* (does not reflect) almost all the light waves at the violet end. Yellow paper reflects red and green light, as well as yellow light, but absorbs most blue light.

In each of these cases, we have removed parts of the spectrum from white light to form colors. This process, color by subtraction, forms the closest link between color in light and color in objects. It explains why the colors in objects mix the way they do. If we put yellow and blue glass marbles in a plastic bag and hold them up to the light, they will appear green from a distance as the light shines through them. The yellow marbles transmit red, orange, yellow, and green light, but absorb blue and violet. The blue marbles transmit green, blue, and violet light, but absorb red, orange, and yellow. Green is the one color that both yellow and blue marbles transmit. In the same way, a mixture of yellow paint and blue paint makes green paint. In both cases, both yellow and blue subtract part of the spectrum. The remaining part is the new color.



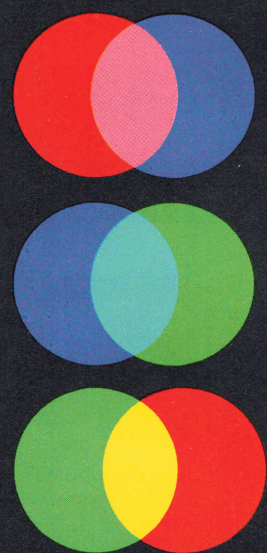
The color white is made by *addition* when the three primary colors are blended. Each primary color can be made by *subtraction* if white light is passed through a piece of colored glass that absorbs, or subtracts, all other colors.

COMPLEMENTARY COLORS IN LIGHT

Complementary colors in light are any two colors that form white light when combined. We can produce the three most important complementary colors in light by combining pairs of primaries. If we shoot a beam of red light and a beam of blue light onto a white screen together, they form a bluish red called *magenta*. If we beam blue and green lights onto the screen, we form a bluish green called *cyan*. With green and red lights, we form yellow. If we combine any one of these three complementary colors with the third primary color, we produce white light. For example, when we beam yellow light (made up of green and red) onto the screen and then add blue, the third primary color, we form white.

If we block off any color in the spectrum, the remaining colors will form its complementary. If we take out green, the remaining light is magenta. Scientists sometimes call yellow light by the odd name of *minus blue*. They mean that yellow light can be thought of as white light with the blue taken out.

The complement of a primary color is the color formed by blending the other two primaries.



Red and blue blend to make magenta, the complement of green.

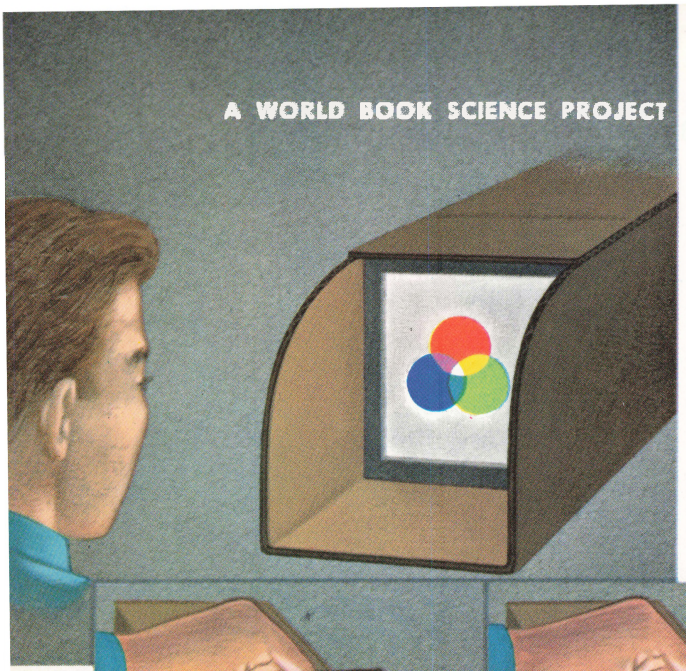
Blue and green blend to make blue-green, the complement of red.

Green and red blend to make yellow, the complement of blue.

A WORLD BOOK SCIENCE PROJECT

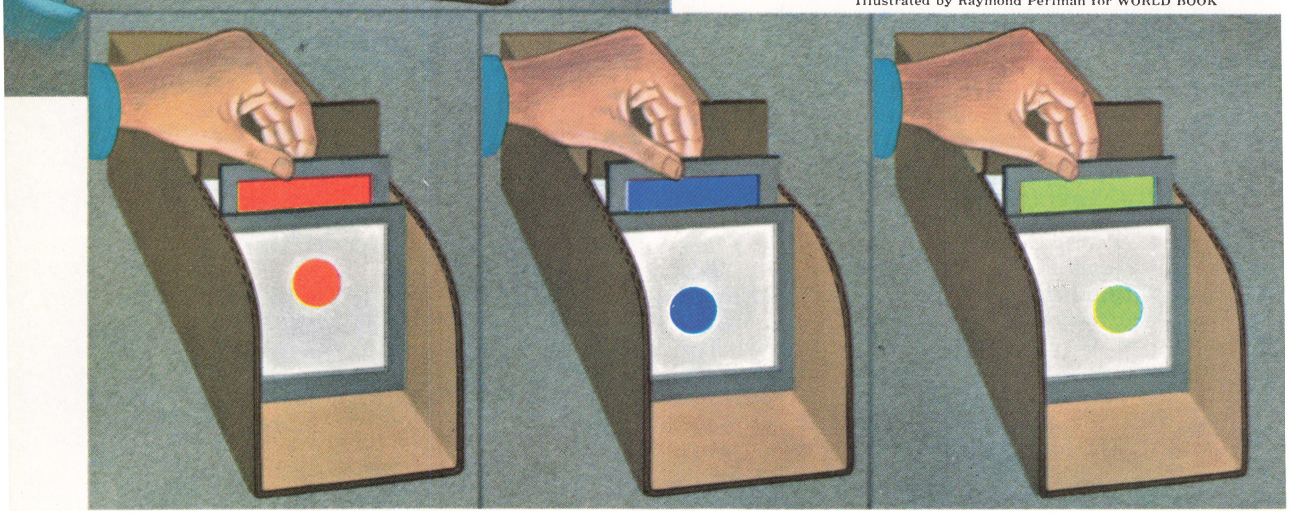
CREATING COLOR WITH LIGHT

The purpose of this project is to learn how colors are created by adding and subtracting colored light. You can perform this demonstration with a color projector built from common materials.



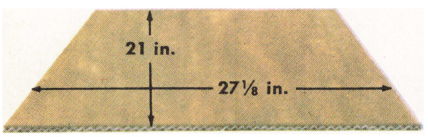
To Create Color by Addition, turn the projector on so you see red, green, and blue circles, *left*. Where these circles overlap, the colors add to form new colors—yellow, blue-green, magenta, and white. Never run the projector for more than a few minutes. It becomes hot and must be allowed to cool.

Illustrated by Raymond Perlman for WORLD BOOK



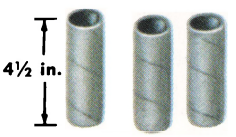
To Create Color by Subtraction, turn the projector on so that the red, green, and blue circles show. Then, insert colored filters one at a time. A red filter subtracts blue and green; a blue filter subtracts red and green; and a green filter subtracts red and blue. Subtracted colors may not disappear entirely from the screen because the simple filters may not work perfectly.

MATERIALS

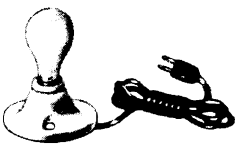


Stiff corrugated cardboard

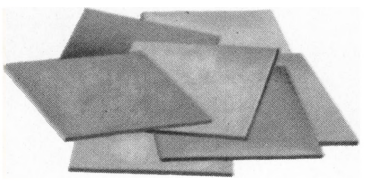
2-pound coffee can open at both ends



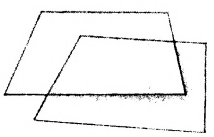
3 cardboard tubes 1¼-inch diameter



100-watt bulb and socket



7 pieces of cardboard 5 inches square



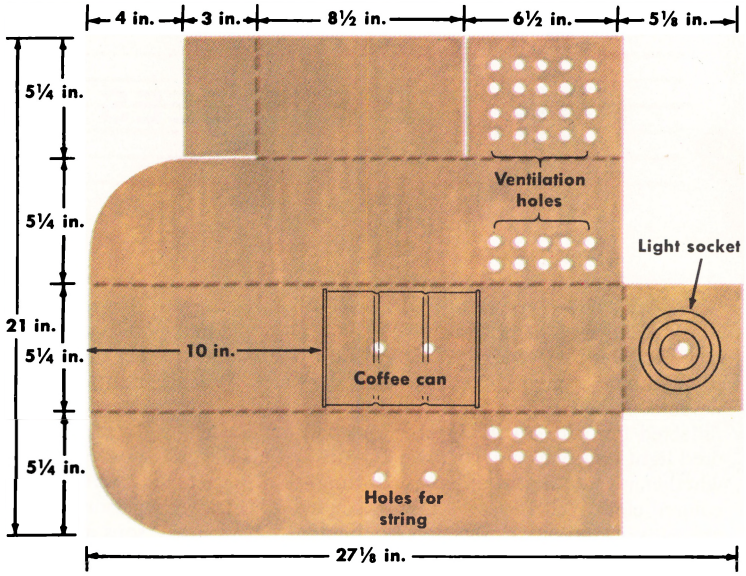
Tracing paper

Aluminum foil

Colored cellophane or gelatin 5 inches square

ASSEMBLY

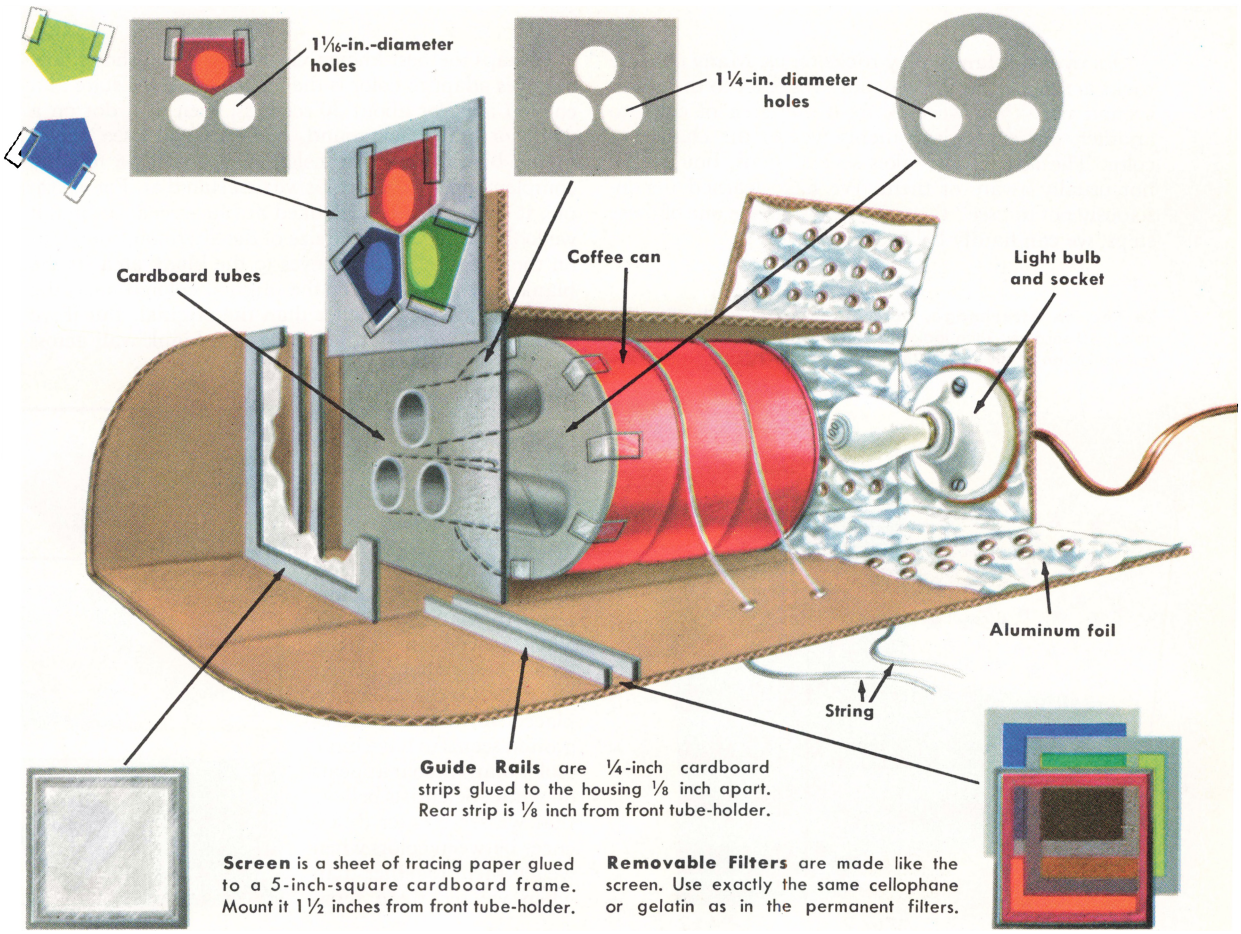
Cut the projector housing from corrugated cardboard as shown, *right*. Fold and assemble as shown, *below*. First, tie the coffee can in place with string. Then assemble the tubes, permanent filters, and screen. Follow the dimensions as closely as possible, or the color circles may not overlap properly on the screen.



Permanent Filters are mounted on a 5-inch-square piece of cardboard held by guide rails. Centers of the holes are ⅞ inch from the center of the square. Try various shades of red, green, and blue filters to get white where circles overlap on the screen.

Front Tube-Holder is a 5-inch-square cardboard sheet taped to projector housing 2½ inches from the front of the coffee can. The centers of the holes are ⅞ inch from the center of the square. The cardboard tubes are taped in place.

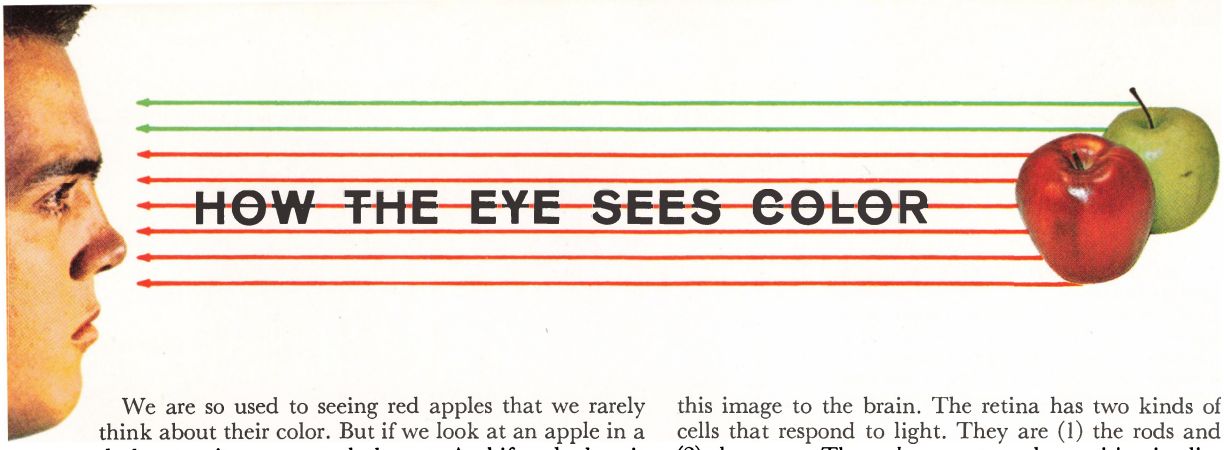
Rear Tube-Holder is a 5-inch-diameter cardboard circle taped to the front of the coffee can. The centers of the holes are 1⅜ inches from the center of the circle. The tubes are inserted through the holes so they extend 2 inches into the coffee can.



Guide Rails are ¼-inch cardboard strips glued to the housing ⅛ inch apart. Rear strip is ⅛ inch from front tube-holder.

Screen is a sheet of tracing paper glued to a 5-inch-square cardboard frame. Mount it 1½ inches from front tube-holder.

Removable Filters are made like the screen. Use exactly the same cellophane or gelatin as in the permanent filters.



HOW THE EYE SEES COLOR

We are so used to seeing red apples that we rarely think about their color. But if we look at an apple in a dark room, it may seem dark gray. And if we look at it under a blue or green light, it will appear black. When we look at something, we see it in terms of the light reflected from it. A colored object usually reflects colored light into our eyes when we look at it. This is true whether we look at an apple, a painting, or a piece of colored cloth. Whenever we discuss colored objects, we are actually talking about colored lights—the rays of colored light reflected from objects.

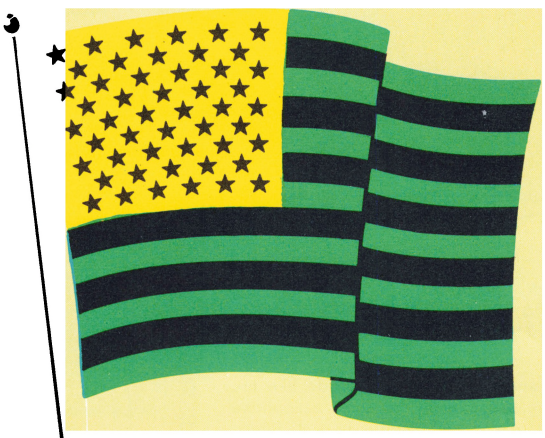
Light reflected from an object travels to the sensitive area at the back of the eye, which is called the *retina*. An image forms there, and the nerves in the retina send this image to the brain. The retina has two kinds of cells that respond to light. They are (1) the rods and (2) the cones. The *rods* are extremely sensitive in dim light, but they do not respond to color. The *cones*, which respond only to stronger light, provide our color vision. In dim light, when only the rods respond, our eyes do not see color. See Eye (How We See).

A few persons can see only certain colors. Even fewer persons can see only white, gray, and black. These persons are *color blind* (see Color Blindness). Many animals have no color vision at all. They probably see objects as various shades of gray. This fact emphasizes that color is as much something happening in our eyes as it is something happening in the world around us.

HOW COLOR FOOLS THE EYE

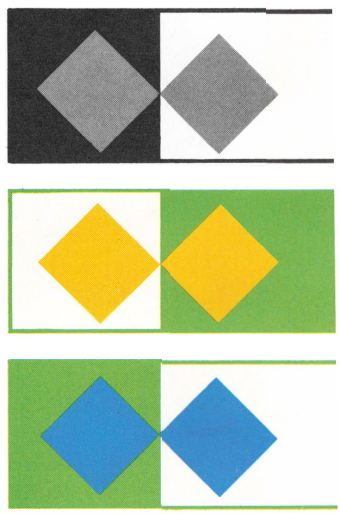
Our eyes constantly play tricks on us. Many of these tricks are related to the way our eyes react to the colors around us. When we look from one area of color to another, our eyes adapt themselves to the change of color. The adaptation takes several steps, but we are not usually aware of them. We have learned unconsciously not to "see" them. When we do see one of these steps, we can hardly believe our eyes.

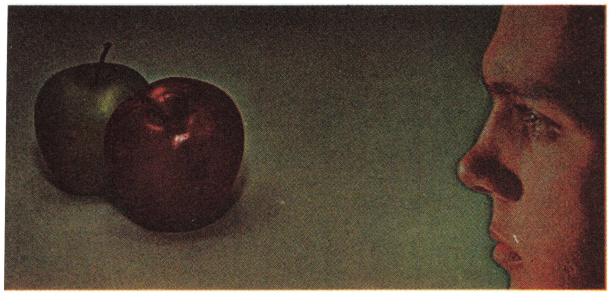
To See an Afterimage, stare at the center of the flag for about 30 seconds. Then look at a sheet of white paper. You will see an image of the flag with its proper colors.



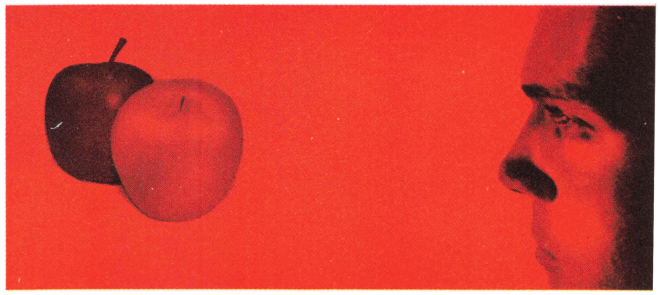
Perhaps the best known visual effect that shows how our eyes adapt to color is the *afterimage*. If we stare at a colored area for about 30 seconds, then at a dot on a white or gray background, our eyes will "see" color in the blank area. The color we see will be roughly complementary to the color we first stared at. For example, it will be red if we looked at blue-green, or blue if we looked at yellow. The size of the afterimage depends on the distance from our eyes to the blank area. If the blank area is closer than the original colored area, the afterimage will be smaller than the original. But if we stare at the color and then look at a blank wall across the room, the afterimage will be much larger.

Another surprising visual effect is that the same color looks different on two different background colors. Gray looks much lighter when surrounded by black than when surrounded by white. Yellow seems to contain more red when placed on a green area than when placed on white. And a blue area placed on a green background seems to have more violet than when it appears on white. Scientists believe that we see greater differences between colors when we see them together than when we see them sepa-

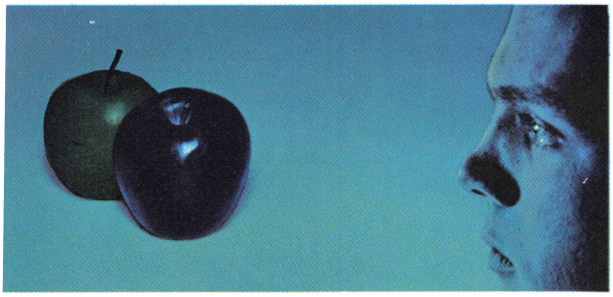




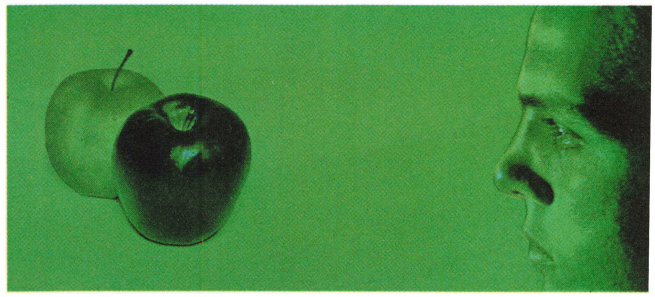
All colored objects appear gray when seen in a dark room.



Under red light, red appears normal, but green looks black.



Under blue light, both red and green objects look black.

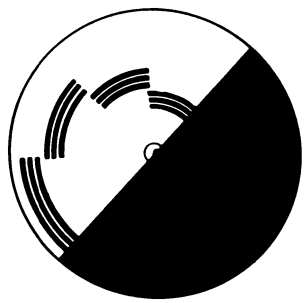


Under green light, green appears normal, but red looks black.

rately. They believe that the eye automatically becomes sensitive to one color when it sees the complementary color.

One of the commonest effects of color adaptation is that we usually accept a color as the same under both artificial light and strong sunlight. The yellowish color of light from an electric lamp changes most colors, but our eyes tend to see the colors unchanged. However, it is best to match colors only in daylight.

Probably the most interesting color illusion is to see color where no color exists. Narrow black lines placed close together seem to take on color if we stare at them long enough. When moved, as in a device called *Benham's disk*, they seem to have several colors. If the disk spins at a rate of 5 to 15 turns a second, the short curved lines are seen as colored rings. If the disk spins to the right, the inner rings appear red and the outer rings blue. If it spins to the left, the inner rings seem blue and the outer ones red. An English newspaperman, Charles E. Benham (1860-1929), invented a spinning top in 1894 that showed this effect. But a German psychologist, G. T. Fechner (1801-1887), had demonstrated the effect in 1838. The effect is known as *Fechner's Colors*.

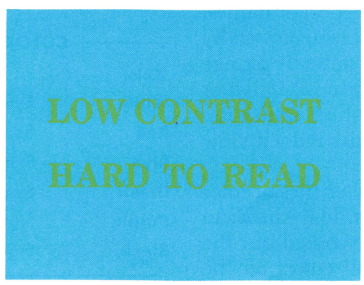


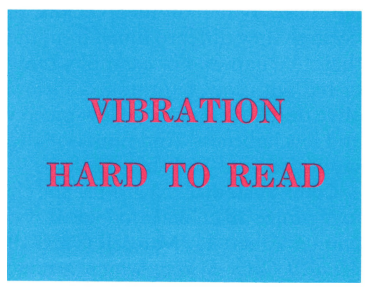
Benham's Disk has only black and white markings, but it appears to have colored rings when it spins. You can draw the disk with black ink on white cardboard. Stick a pin through the center and hold one end of the pin as you spin the disk first in one direction and then the other.

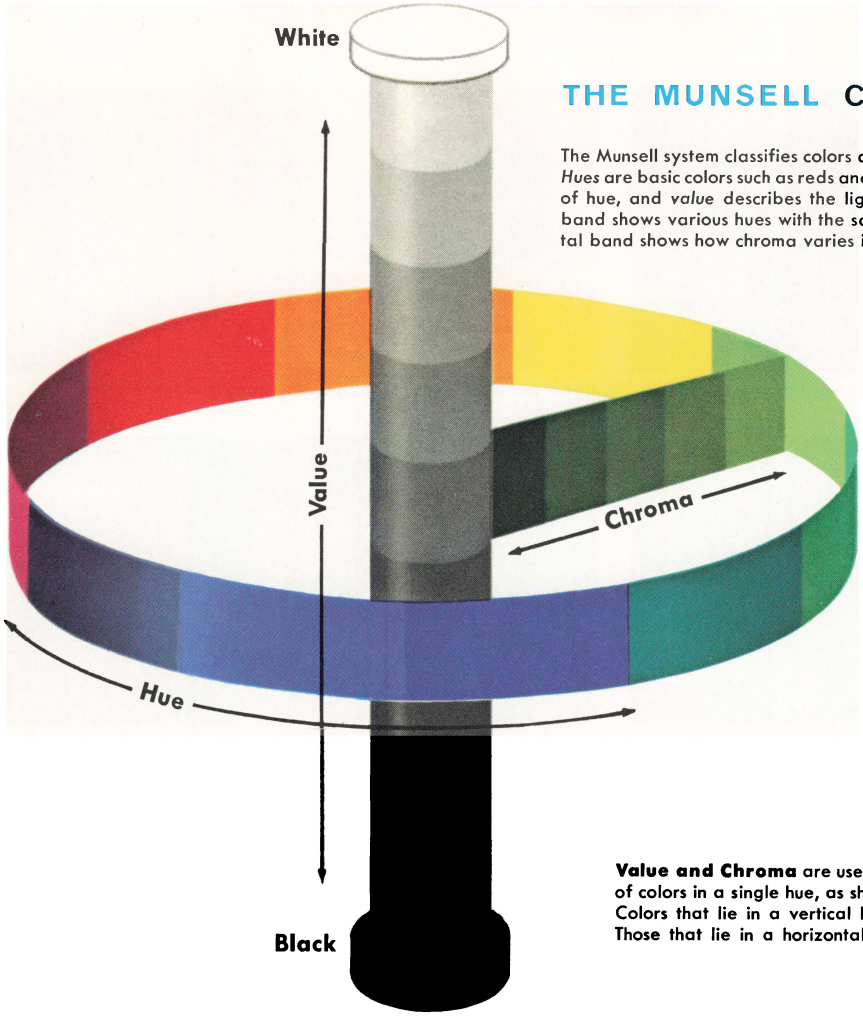
Reading Colored Letters may be easy or hard, depending on their contrast with the color of the background. In the example on the right, the letters seem to vibrate because the eye cannot focus on red and blue at the same time.

HIGH CONTRAST

EASY TO READ

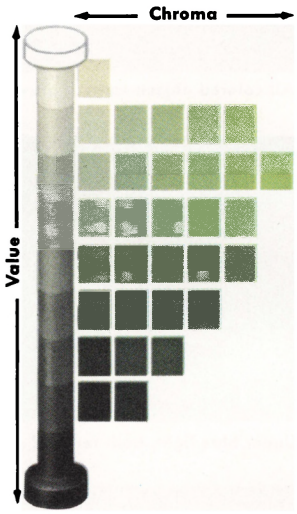






THE MUNSELL COLOR SYSTEM

The Munsell system classifies colors according to hue, chroma, and value. *Hues* are basic colors such as reds and blues. *Chroma* measures the amount of hue, and *value* describes the lightness. In the diagram, the circular band shows various hues with the same value and chroma. The horizontal band shows how chroma varies in colors of the same hue and value.



Value and Chroma are used to identify a large number of colors in a single hue, as shown in the smaller diagram. Colors that lie in a vertical line have the same chroma. Those that lie in a horizontal line have the same value.

CHARACTERISTICS OF COLOR

Color experts use three basic terms to describe colors in objects: (1) hue, (2) saturation, and (3) lightness. *Hue* is usually the basic name of a color. Red, for example, is a hue, but there are hundreds of reds. *Saturation* is the amount of hue in a color—there is a great deal of red in vermilion, but not much red in pink. *Lightness* indicates how light or dark a color is. Pink is almost as light as white. Vermilion is much darker.

Using these three terms, color experts can accurately describe two or three hundred colors. They estimate that about ten million colors exist. Each color differs from the others in some degree of hue, saturation, or lightness. Some of these colors have special names, because they differ so much from the colors suggested by their hue names. For example, brown is actually orange or red with low saturation and low lightness. Olive or olive drab is yellow or yellow-green with high saturation and low lightness. And pink is really bluish red with low saturation and high lightness.

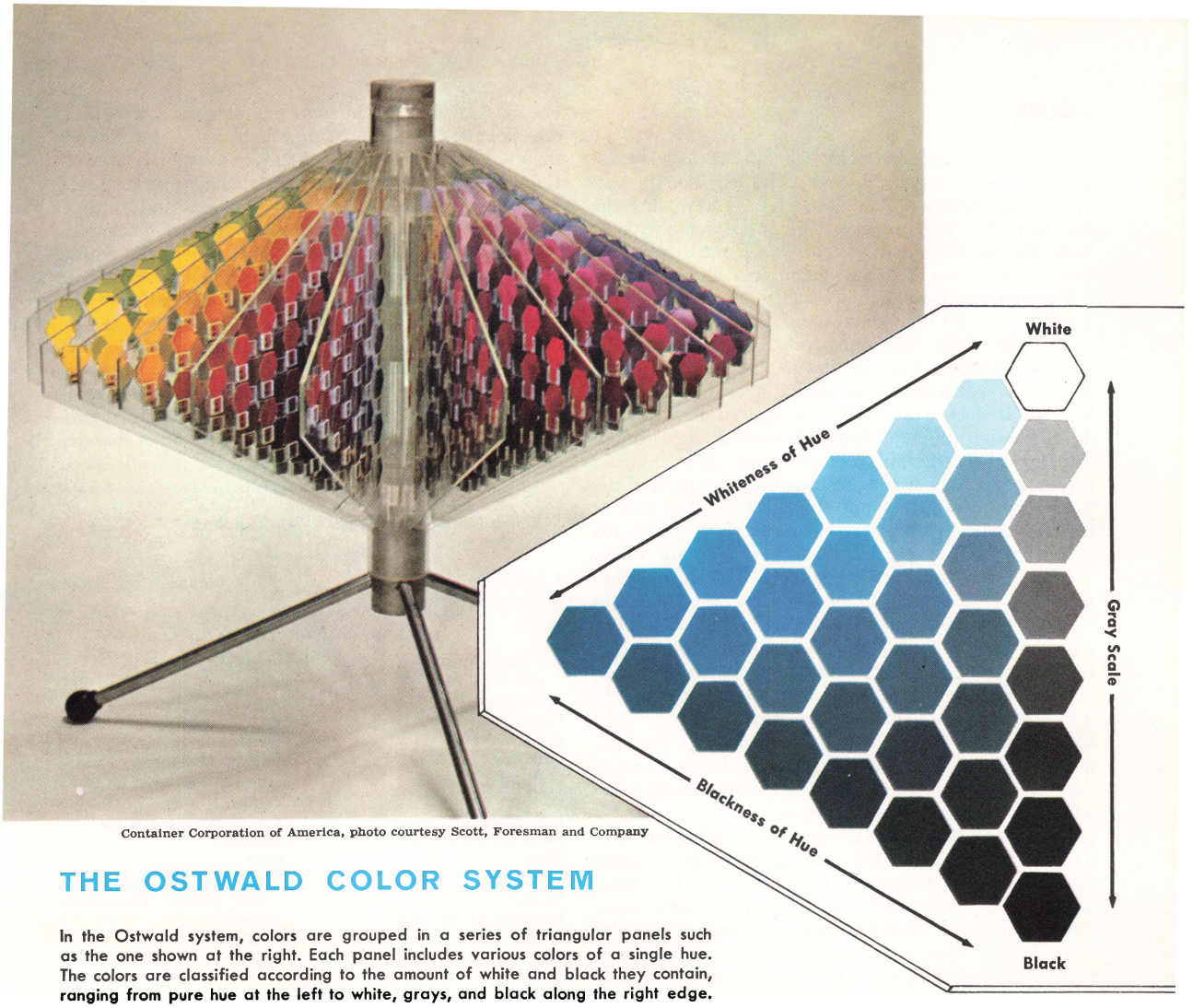
Color Systems. Experts use the characteristics of color to organize all colors into logical systems. The American painter Albert H. Munsell (1858-1918) worked out the *Munsell Color System*, which arranges all colors on the basis of their appearance. Munsell used the terms *value* for lightness and *chroma* for saturation. All the hues appear equally spaced around a circle, as in a color wheel. The value or lightness scale runs like an axle through the wheel. The chroma or saturation scales run like spokes from the central axle to the circle.

The German chemist Wilhelm Ostwald (1853-1932) developed another color system. It arranges colors on triangles and describes them in terms of purity, whiteness, and blackness. Variations on this system have been worked out by scientists in many countries.

In the United States, the National Bureau of Stand-

COLOR IN RELIGIOUS SYMBOLISM

Color	Symbolism
White	Symbol of light; signifies purity, joy, and glory.
Red	Symbol of fire and blood; signifies charity.
Blue	Symbol of heaven; signifies truth.
Green	Symbol of nature; signifies the hope of eternal life.
Purple	Signifies sorrow and suffering.
Black	Signifies death, in most countries.



Container Corporation of America, photo courtesy Scott, Foresman and Company

THE OSTWALD COLOR SYSTEM

In the Ostwald system, colors are grouped in a series of triangular panels such as the one shown at the right. Each panel includes various colors of a single hue. The colors are classified according to the amount of white and black they contain, ranging from pure hue at the left to white, grays, and black along the right edge.

ards and the Inter-Society Color Council have worked out a system for naming colors. They have defined more than 270 colors, and related 7,500 other common names to the basic list.

Measuring Colors is one of the ways scientists study colors and color mixture. The science of color measurement is called *colorimetry*. Scientists use an instrument called a *spectrophotometer* to measure exactly how much colored light a colored object reflects or transmits. The instrument compares the colored light with the normal reflection from a white surface to obtain a *spectrophotometric curve* or *spectral reflectance curve*. Scientists use the curves to predict accurately the light formed by either additive or subtractive color mixtures.

History of Color Studies

Early Theories about the nature of color developed in many countries of the ancient world. As early as the 1900's B.C., the Babylonians showed an interest in the subject. Most early theories assumed that color was one of the properties of an object, like hardness or weight. In the 400's B.C., the Greek philosopher Empedocles stated that each object gave off little particles that passed through the eyes. He believed that the

MEANING OF COLOR IN HERALDRY

Color	Signifies
Yellow or gold	Honor and loyalty.
Silver or white	Faith and purity.
Red	Bravery and courage.
Blue	Piety and sincerity.
Black	Grief and sorrow.
Green	Youth and hope.
Purple	High rank and royalty.
Orange	Strength and endurance.
Red-purple	Sacrifice.

COLORS OF THE SEASONS AND MONTHS

Spring—pink and green.
Summer—yellow and blue.
Autumn—orange and brown.
Winter—red and black.

January—black and white.
February—deep blue.
March—gray or silver.
April—yellow.
May—lavender or lilac.
June—pink or rose.
July—sky blue.
August—deep green.
September—orange or gold.
October—brown.
November—purple.
December—red.

eyes either produced a color reaction because of the particles, or recognized the particles as colored. Aristotle, a later Greek philosopher, seems to have been the first to realize that the eyes cannot see color without light. But he thought that color was created by something transparent between the object and the eyes.

Newton and Goethe. The English scientist Sir Isaac Newton (1642-1727) discovered the spectrum. He found that white light contains all the colors of the rainbow. Newton was the first to demonstrate that a prism cannot divide monochromatic light into a rainbow, as it does white light. He proved that colored lights, though different from one another, are alike in the ways they combine to form white light. Newton invented the color wheel. He put the pure hues of the spectrum on the outside and shaded them in to gray at the center. In all his work, he started with simple experiments and developed theories to explain them.

Johann Wolfgang von Goethe (1749-1832), the German poet, was fascinated by color. He worked out complicated theories about it. But Goethe regarded work with the spectrum and prisms as tricks to fool the eye. He thought of colored lights as darker than white light, and did not believe that they made up white light. He believed that all colored lights were formed of light and darkness. When Goethe announced his theories, most persons thought that they contradicted those of Newton. Actually, the two men disagreed on only a few points, but differed over interpretation.

The Three-Component Theory developed from Newton's work. In 1801, the English physicist Thomas Young (1773-1829) suggested that the eye has three kinds of color sensitivities. He believed that these sensitivities respond to what he called red, green, and violet light. Young later modified his theory and declared that nature has three basic sensations—red, green, and violet—that cause all colors.

A German physicist, Hermann von Helmholtz (1821-1894), enlarged Young's final theory. His work, published in 1867, made the three-component theory the basis for nearly all later work in color science. To honor both men, scientists call their combined work the Young-Helmholtz theory. It has been widely accepted, especially by physicists, because it fits in well with other theories about the behavior of light.

Helmholtz was not the only physicist who worked with Young's theories. In 1860, the Scottish physicist James Clerk Maxwell (1831-1879) became the first man to measure and define the spectrum accurately. The next year, while trying to prove Young's theory, Maxwell publicly produced the first color photograph.

The Opponent Color Theory followed somewhat the ideas of Goethe. Ewald Hering (1834-1918), a German physiologist, published this theory in 1874. He suggested that three pairs of opposing sensations produce all colors. The three pairs were blue and yellow, red and green, and black and white. Hering pointed out that no single color could contain both the colors in one of these pairs. The opponent color theory has been widely accepted, particularly by psychologists, because it fits in well with other theories of perception.

Recent Developments. Many scientists since Helmholtz and Hering have suggested color theories. No one has solved all the problems of color perception, and scientists continue to search for a satisfactory theory. For example, the American inventor Edwin H. Land (1909-) proposed a color theory in 1959. He demonstrated visual effects that were new and startling to most of his viewers. In one, he showed black-and-white photographs of the same scene, one made with a red filter and the other with a green filter. When he projected the red-filtered slide with red light and the green-filtered slide with white light, he seemed to produce full color. Land sought to explain these effects in his theory, and seemed to challenge all color work since Newton. But scientists familiar with the effects of color adaptation and visual perception argued that his demonstrations did not actually conflict with other theories about color.

RALPH M. EVANS

Critically reviewed by FABER BIRREN

Related Articles in WORLD BOOK include:

BIOGRAPHIES

Land, Edwin H.
Maxwell, James Clerk
Newton, Sir Isaac

OTHER RELATED ARTICLES

Animal (Animal Defenses; color picture: Animal Camouflage)
Camouflage
Carmine
Chrome
Colloid
Color Blindness
Dressmaking
Dyes and Dyeing
Flag
Heraldry
Indigo
Interior Decoration
Light
Map
Neon
Ocher
Paint
Photography
Pigment
Printing (picture: Printing with Process Colors)
Prism
Protective Coloration
Rainbow
Sepia
Television (picture: How Color Television Works)
Ultramarine
Umber

Outline

I. Color in Paint
A. The Color Wheel
B. The Color Triangle
C. Color Harmony
II. Color in Light
A. The Spectrum
B. Color by Addition or Subtraction
C. Primary Colors
D. Complementary Colors
III. How the Eye Sees Color
IV. How Color Fools the Eye
V. Characteristics of Color
A. Color Systems
B. Measuring Colors
VI. History of Color Studies

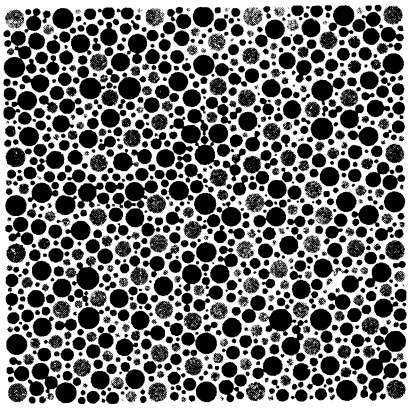
Questions

Why is light needed before we can see colors?
What is *hue? Saturation? Lightness?*
How do complementary colors in light differ from complementary colors in paints?
Who discovered the spectrum?
What is an *afterimage?*
Why do blue and yellow paints combine to form a green color?
What are the primary colors of paint? Of light?
How can scientists predict the results of mixing different colors?
What are *tertiary colors?*
Why does color so often fool the eye?

Reading and Study Guide

For a *Reading and Study Guide on Color*, see the RESEARCH GUIDE/INDEX, Volume 22.

COLOR BLINDNESS

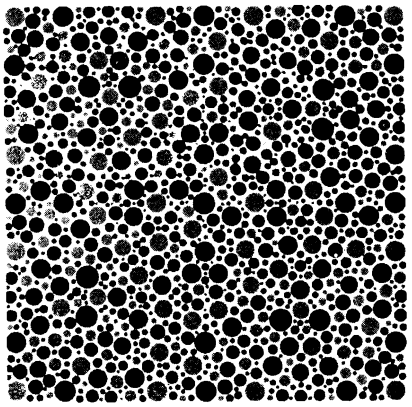


Testing Color Vision. These color patterns are examples of the figures used to find out whether persons confuse certain colors with others.

At the Left, persons who confuse both blue and yellow may not see the ○ and ×.

At the Right, persons who confuse both red and green may not see the ○ and ▷.

These plates are copyrighted by American Optical Company and are reproduced here by permission. However, these reproductions do not present true testing conditions and cannot be used as a color vision deficiency test.



COLOR BLINDNESS, also called DALTONISM, is not being able to tell all colors apart. Most color-blind persons can see only two basic colors of the rainbow, and they confuse other colors. This kind of color blindness is called *dichromatic vision*. Most persons with dichromatic vision can see a fairly wide range of yellows and blues. But they tend to confuse reds with greens, and some reds or greens with some yellows. Only a very few persons are truly blind to all colors. They have *achromatic vision*. Persons with achromatic vision see the world in shades of white, gray, and black—somewhat like a black-and-white photograph.

More men than women are color blind. More than 4 of every 100 men are color blind, compared to about 1 of every 200 women. There is no cure for color blindness.

Many animals, including cats, dogs, and horses, probably do not see colors as we do. But the condition is normal in their eyes, not defective.

Many color-blind persons do not realize that their eyesight is defective. They have learned to use the color names that everyone else uses. These persons do not know that they do not see the colors that others see. They may be hampered in their everyday activities, and their condition may place them in danger. If they confuse red and green, for example, they may only be able to tell traffic signals apart by their brightness. Many armed forces refuse to accept color-blind persons for military service.

Most persons can be easily tested for color blindness. The *Hardy-Rand-Rittler* (*H-R-R*) and *Ishihara* tests indicate both the type and the degree of color blindness. In these and similar tests, colored triangles, squares, and other shapes lie buried in a jumble of dots. These dots vary in both color and intensity. As the person identifies the colored shapes, an examiner can determine his ability to see colors. Another test, the *Holmgren* test, measures the ability to match colors.

Scientists believe that color blindness is inherited. A color-blind man who marries a woman with normal vision has children with normal vision. But the defect is hidden in the daughters, and they can pass it on to their children. If a color-blind man marries a woman whose father is color blind, probably half of his children will be color blind.

WILLIAM A. MANN

COLOR GUARD. See FLAG (Carrying the Flag).

COLOR ORGAN. See CLAVILUX.

by Arnold Ryan Chalfant & Associates for WORLD BOOK

To a Color-Blind Person, some colors look the same. A person who confuses red and green with other colors may say these pictures look the same or are equally colorful. Most persons with normal color vision would say the photograph on the right is the more colorful of the two.

Robert Koropp

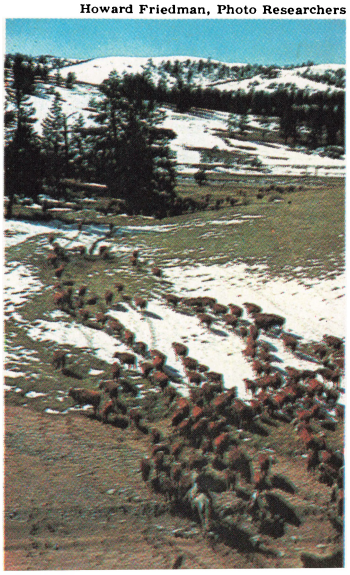
Rocky Mountains Form a Backdrop for a Ranch near Hygiene

Skier at Aspen

Margaret Durrance, Photo Researchers

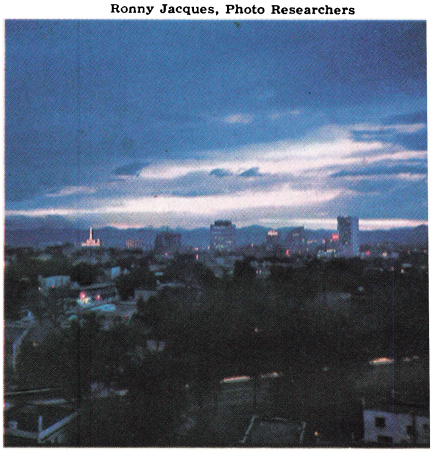
Cattle Drive near Pikes Peak

Howard Friedman, Photo Researchers



Denver at Night

Ronny Jacques, Photo Researchers



COLORADO

THE CENTENNIAL STATE

COLORADO is a state of unusual natural beauty. The scenic wonders of the Rocky Mountains and the cool, pleasant climate make the state a center for summer tourists. In winter, the deep, powdery snow of Colorado attracts skiers to world-famous resorts. About 8 million visitors a year travel to such tourist areas as Aspen, Estes Park, and Colorado Springs.

But not all of Colorado is mountainous, and only part of the state's income comes from tourists. Most Coloradans live and work on the dry, flat plains that make up the eastern two-fifths of the state. Tunnels bored through the mountains bring water to the plains for busy cities and prosperous farms. Factories on the plains make manufacturing the leading economic activity in Colorado. These factories also make Colorado the leading manufacturing area in the Rocky Mountain States.

Herds of cattle and sheep graze on the mountains and plains. Irrigated farms produce rich crops of potatoes and sugar beets. Wheat fields spread across the plains.

Mining also has an important part in the state's economy. A series of mining booms has sparked Colorado's growth since the 1850's. The colorful story of Colorado gold and silver mining in the 1800's has become famous through music. The musical comedy *The Unsinkable Molly Brown* and the opera *The Ballad of Baby Doe* describe life during the great mining booms.

Colorado mines still produce gold and silver ores. But petroleum is the state's most important mineral product today. In addition, Colorado leads the nation in the production of molybdenum, a metal that hardens steel. The state also ranks high in the production of uranium, the raw material for atomic power.

The U.S. government owns more than a third of Colorado's land. The government controls grazing, logging, and mining on those lands. The U.S. Mint in Denver makes coins. One of the state's largest employers manufactures space vehicles for the government. The U.S. Air Force has its academy close to Colorado Springs, its defense headquarters in nearby Cheyenne Mountain, and its finance center in Denver.

The Spanish word *colorado* means *colored red.* The name was given first to the Colorado River, which flows through canyons of red stone. The state was named for the river. Colorado's nickname is the *Centennial State.* Colorado joined the Union in 1876, the *centennial* (100th anniversary) of the Declaration of Independence.

Denver is the capital and largest city of Colorado. For the relationship of Colorado to other states in its region, see the article on the ROCKY MOUNTAIN STATES.

The contributors of this article are Tim K. Kelley, Professor Emeritus of Geography at the University of Colorado; Pasquale L. Marranzino, editorial writer for the Rocky Mountain News *in Denver; and Michael McGiffert, former Professor of History at the University of Denver.*

FACTS IN BRIEF

Capital: Denver.

Government: *Congress*—U.S. senators, 2; U.S. representatives, 5. *Electoral Votes*—7. *State Legislature*—senators, 35; representatives, 65. *Counties*—63.

Area: 104,247 sq. mi. (269,998 km²), including 481 sq. mi. (1,246 km²) of inland water; 8th in size among the states. *Greatest Distances*—east-west, 387 mi. (623 km); north-south, 276 mi. (444 km).

Elevation: *Highest*—Mount Elbert, 14,433 ft. (4,399 m) above sea level. *Lowest*—3,350 ft. (1,021 m) above sea level along the Arkansas River in Prowers County.

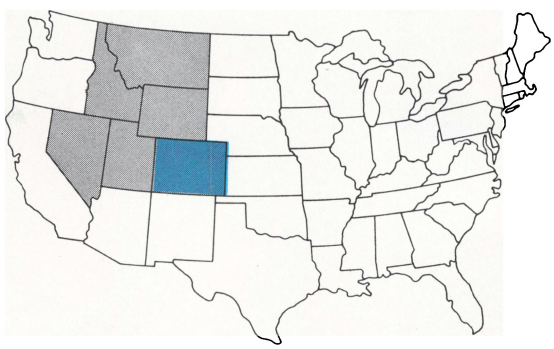
Population: *Estimated 1975 Population*—2,423,000; 28th among the states; distribution, 79 per cent urban, 21 per cent rural; density, 23 persons per sq. mi. (9 persons per km²). *1970 Census*—2,207,259.

Chief Products: *Agriculture*—beef cattle, corn, milk, sheep, sugar beets, wheat. *Manufacturing and Processing*—fabricated metal products; food and food products; nonelectrical machinery; printing and publishing; stone, clay, and glass products. *Mining*—coal, molybdenum, natural gas, petroleum, sand and gravel, uranium, vanadium, zinc.

Statehood: Aug. 1, 1876, the 38th state.

State Motto: *Nil sine Numine* (Nothing without Providence).

State Song: "Where the Columbines Grow." Words and music by A. J. Fynn.



Colorado (blue) ranks eighth in size among all the states, and third in size among the Rocky Mountain States (gray).

Constitution of Colorado was adopted in 1876. It has been *amended* (changed) about 65 times. All amendments must be approved by the people in an election. They may be proposed by a two-thirds vote of the legislature, by a petition of the voters, or by a constitutional convention. A constitutional convention requires the approval of two-thirds of the legislators and a majority of those voting on the issue in an election.

Executive. The governor and lieutenant governor of Colorado are elected as a team to four-year terms. Voters cast a single vote for both officials. The governor receives a salary of $40,000 a year.

The governor of Colorado has more power than the governors of many other states. For example, he may veto specific items in money bills, but sign the rest of the bill into law. The governor appoints the revenue director and the adjutant general. The people elect the secretary of state, treasurer, and attorney general to four-year terms. The legislature appoints the auditor to a five-year term. Under a constitutional amendment approved in 1966, the state reorganized the executive branch. Over 100 agencies, boards, and other units were consolidated into 17 departments.

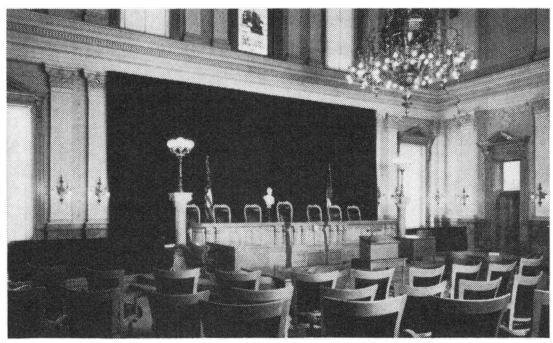
Legislature, called the *General Assembly*, consists of a 35-member Senate and a 65-member House of Representatives. Senators serve four-year terms, and representatives serve two-year terms. The Assembly meets each year in January. Sessions in odd-numbered years may take up any subject. In even-numbered years, only money bills and bills from the governor can be considered.

In 1964, Colorado *reapportioned* (redivided) its legislature to provide equal representation based on population. The plan called for the subdistricting of counties electing more than one legislator. The state Supreme Court ruled the subdistricts unconstitutional, and they were eliminated in 1965. The voters then initiated a constitutional amendment allowing subdistricts, and passed it in 1966. In 1967, the legislature acted on the amendment by dividing the state into single-member legislative districts. In 1972, Colorado reapportioned its legislature on the basis of the 1970 census.

Courts. Colorado's highest court is the Supreme Court, composed of a chief justice and six associate justices. The governor appoints the justices. After a justice serves for two years, he must win the voters' approval in an election. If approved, he serves a 10-year term. His later terms are for 10 years, but he must be voted in each time.

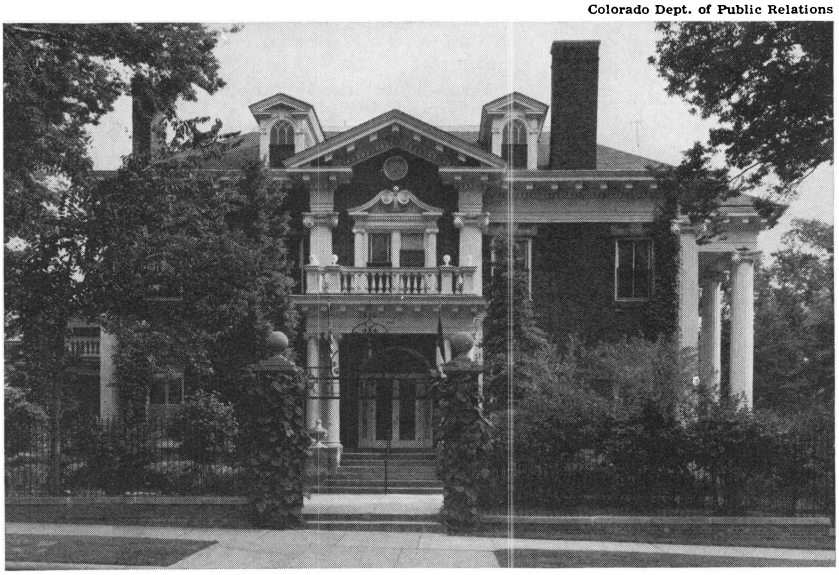
Colorado's next highest court is the six-member court of appeals. Most major civil and criminal cases are tried in district courts in the state's 22 judicial districts. Appellate and district court judges are appointed and approved like justices. However, the appellate court judges serve full terms of eight years, and district court judges serve six years. District courts may act as probate or juvenile courts, except in Denver where those courts are separate. Each Colorado county has a county court, and larger towns have municipal courts.

Local Government is carried on through 63 counties and about 260 cities and towns. The city and county of

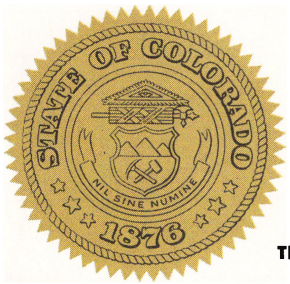


Colorado Supreme Court sits in the Capitol in Denver. Thick maroon draperies form a backdrop for the judicial bench.

Colorado Dept. of Public Relations



The Governor's Mansion, in Denver, is about eight blocks from the state Capitol. The building is constructed of red brick with white stone trimming. The mansion, completed in 1908, was given to the state in 1960 by the Boettcher Foundation of Denver.



The State Seal

Symbols of Colorado. On the seal, the triangular figure represents the "all-seeing" eye of God. The *fasces* (bound rods) are a symbol of power. The three mountains stand for the state's rugged land, and the pick and hammer for the importance of mining. The seal was adopted in 1877. On the flag, adopted in 1911, the red C stands for *Colorado*, which is Spanish for *colored red*. The golden ball is said to represent the state's gold production.

Flag and flower illustrations, courtesy of Eli Lilly and Company

The State Flag

Denver operate as a single government, with the same borders and the same officials. Each of the other 62 counties is governed by three commissioners elected by the voters to four-year terms.

Communities with more than 2,000 persons are called *cities*, and those with smaller populations are *towns*. Cities may adopt *home rule* charters, which give them greater control over their own affairs. Under certain conditions, home rule charters and laws passed under such charters may overrule state laws. Most of Colorado's cities use the mayor-council form of government. Several cities have city managers. All the towns have a mayor and a board of trustees.

Taxation. State taxes provide almost three-fourths of the state government's income. Income taxes, motor fuel and highway taxes, and a sales tax produce the largest amounts. About a fourth of Colorado's income comes from U.S. government grants and other programs.

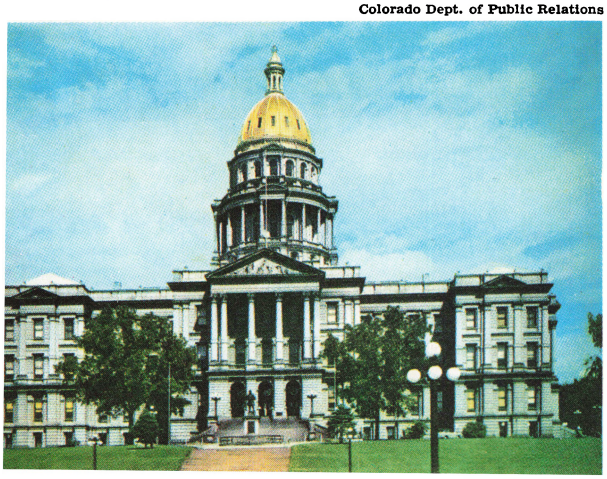
Politics. Colorado voters have elected about as many Democrats as Republicans to Congress. Voters in Denver and Pueblo usually support Democrats. Voters in Denver's suburbs and in northeastern Colorado generally favor Republicans. Colorado has favored Republicans more often than Democrats in presidential elections. For Colorado's voting record in presidential elections, see ELECTORAL COLLEGE (table).

The State Bird
Lark Bunting

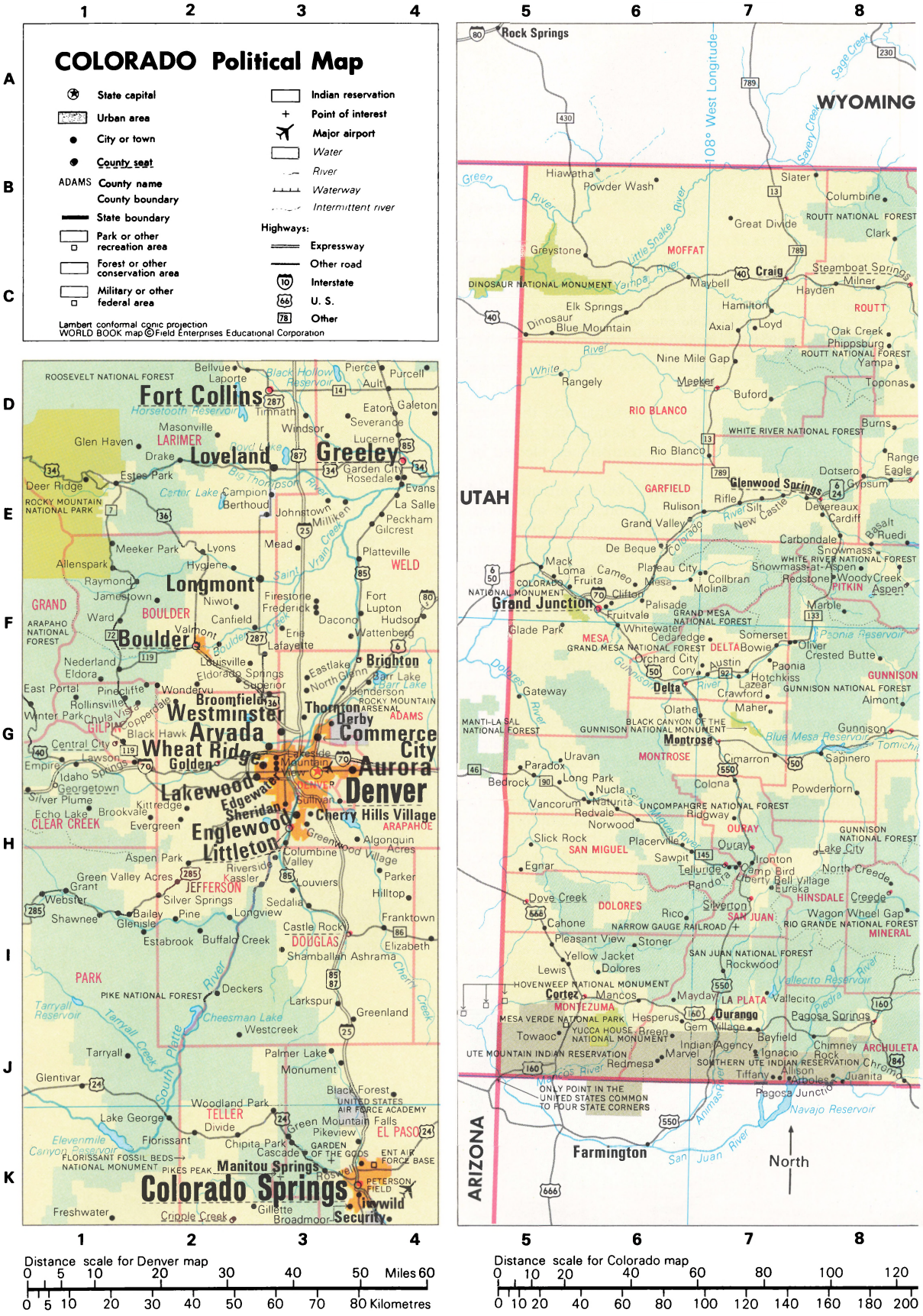
The State Flower
Rocky Mountain Columbine

The State Capitol is in Denver, the capital of Colorado since 1876. Territorial capitals were Colorado City (now Colorado Springs), 1862; Golden, 1862-1867; and Denver, 1867-1876.

Colorado Dept. of Public Relations



The State Tree
Blue Spruce


COLORADO Political Map
State capital
Urban area
City or town
County seat
ADAMS County name
County boundary
State boundary
Park or other recreation area
Forest or other conservation area
Military or other federal area
Indian reservation
Point of interest
Major airport
Water
River
Waterway
Intermittent river
Highways:
Expressway
Other road
Interstate
U. S.
Other
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WYOMING
UTAH
ARIZONA
Rock Springs
Fort Collins
Loveland
Greeley
Longmont
Boulder
Westminster
Aryada
Wheat Ridge
Golden
Arvada
Commerce City
Aurora
Denver
Lakewood
Englewood
Littleton
Cherry Hills Village
Brighton
Thornton
Broomfield
Grand Junction
Montrose
Delta
Durango
Cortez
Farmington
Colorado Springs
Manitou Springs
Pueblo
Greenwood Village
Parker
Castle Rock
Monument
Palmer Lake
Woodland Park
Florissant
Cripple Creek
Victor
Canon City
Salida
Buena Vista
Leadville
Aspen
Glenwood Springs
Steamboat Springs
Craig
Meeker
Rangely
Rifle
Silt
New Castle
Carbondale
Snowmass
Aspen
Redstone
Crested Butte
Gunnison
Almont
Paonia
Hotchkiss
Olathe
Cedaredge
Orchard City
Palisade
Fruita
Loma
Clifton
Collbran
Molina
Mack
De Beque
Plateau City
Rulison
Grand Valley
Parachute
Battlement Mesa
Silverton
Telluride
Ouray
Ridgway
Norwood
Dolores
Cortez
Mancos
Mesa Verde
Hovenweep
Yucca House
Towaoc
Ute Mountain Indian Reservation
Redmesa
Marvel
Ignacio
Bayfield
Durango
Hesperus
Gem Village
Mayday
La Plata
Vallecito
Pagosa Springs
Arboles
Tiffany
Allison
Juanita
Chromo
Archuleta
Chimney Rock
Southern Ute Indian Reservation
Only point in the United States common to four state corners
Navajo Reservoir
San Juan River
Animas River
Los Pinos River
Vallecito Reservoir
Piedra River
Blue Mesa Reservoir
Taylor Park Reservoir
Gunnison River
Uncompahgre River
Dolores River
Colorado River
Green River
White River
Yampa River
Little Snake River
Savery Creek
Sage Creek
Roosevelt National Forest
Rocky Mountain National Park
Arapaho National Forest
Pike National Forest
Manti-La Sal National Forest
Dinosaur National Monument
Colorado National Monument
Mesa Verde National Park
Yucca House National Monument
Gunnison National Forest
Grand Mesa National Forest
Routt National Forest
White River National Forest
San Juan National Forest
Rio Grande National Forest
Gunnison National Monument
Black Canyon of the Gunnison National Monument
Narrow Gauge Railroad
Florissant Fossil Beds National Monument
Pikes Peak
Cheesman Lake
Tarryall Reservoir
Elevenmile Canyon Reservoir
Horsetooth Reservoir
Boyd Lake
Carter Lake
Big Thompson River
Saint Vrain Creek
Boulder Creek
Clear Creek
South Platte River
Cherry Creek
Tarryall Creek
Arkansas River
Eagle
Gypsum
Basalt
Ruedi
Range
Dotsero
Devereaux
Cardiff
Glenwood Springs
Snowmass-at-Aspen
Woody Creek
Pitkin
Marble
Somerset
Oliver
Bowie
Austin
Cory
Paonia
Hotchkiss
Crawford
Maher
Gunnison
Almont
Sapinero
Cimarron
Powderhorn
Colona
Uravan
Paradox
Bedrock
Long Park
Nucla
Naturita
Vancorum
Redvale
Norwood
Ridgway
Ouray
Lake City
Ironton
Camp Bird
Liberty Bell Village
Eureka
Creede
Wagon Wheel Gap
Silverton
Rico
Cahone
Dove Creek
Pleasant View
Stoner
Yellow Jacket
Lewis
Dolores
Rockwood
Egnar
Slick Rock
Placerville
Sawpit
Telluride
Pando
Hiawatha
Powder Wash
Slater
Columbine
Great Divide
Clark
Greystone
Steamboat Springs
Milner
Hayden
Craig
Maybell
Elk Springs
Dinosaur
Blue Mountain
Hamilton
Axial
Loyd
Oak Creek
Phippsburg
Yampa
Toponas
Nine Mile Gap
Meeker
Buford
Rangely
Burns
Rio Blanco
Range
Eagle
Dotsero
Gypsum
Rifle
Silt
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Cardiff
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Basalt
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Snowmass
Aspen
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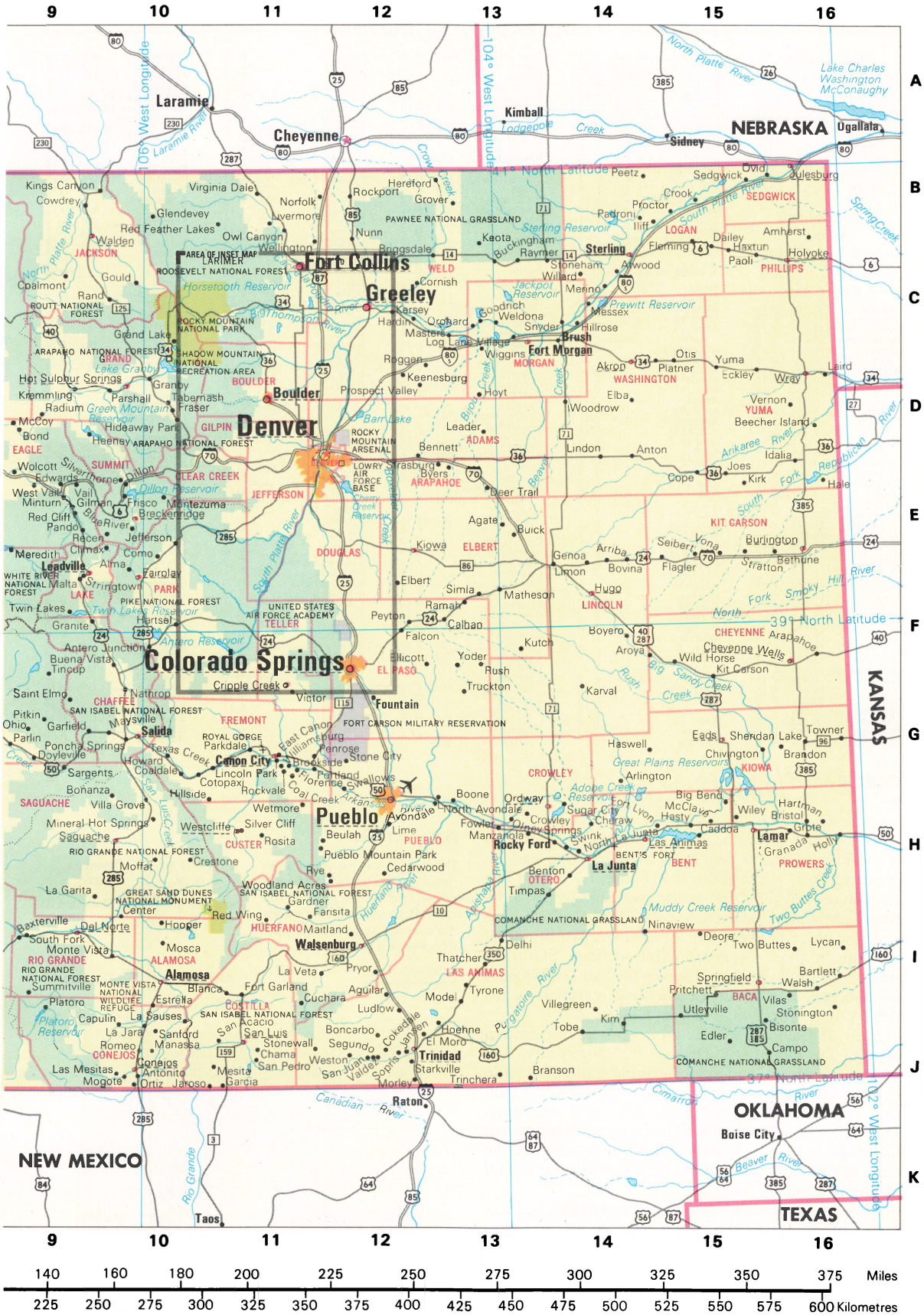
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Sedgwick
Ovid
Fort Collins
Greeley
Sterling
Brush
Fort Morgan
Boulder
Denver
Colorado Springs
Pueblo
Canon City
Salida
Leadville
Fountain
Cripple Creek
Victor
Trinidad
Walsenburg
La Junta
Lamar
Rocky Ford
Springfield
Holyoke
Haxtun
Wray
Yuma
Burlington
Hugo
Limon
Kit Carson
Cheyenne Wells
Goodland
Oakley
Colby
KANSAS
OKLAHOMA
Boise City
TEXAS
NEW MEXICO
Raton
Taos
Alamosa
Durango
Grand Junction
Glenwood Springs
Steamboat Springs
Craig
Rangely
Meeker
Vail
Aspen
Gunnison
Montrose
Telluride
Ouray
Silverton
Pagosa Springs
Cortez
Dolores
Mancos
Farmington
Aztec
Bloomfield
Kirtland
Shiprock
Chama
Ignacio
Bayfield
Durango
Hesperus
Mesa Verde National Park
Ute Mountain Ute Reservation
Navajo Nation
Four Corners
Monument Valley
Navajo Mountain
Rainbow Bridge National Monument
Lake Powell
Glen Canyon National Recreation Area
Page
Kayenta
Tuba City
Cameron
Flagstaff
Sedona
Jerome
Prescott
Prescott Valley
Chino Valley
Williams
Grand Canyon National Park
Grand Canyon Village
Grand Canyon West
Hualapai Indian Reservation
Peach Springs
Seligman
Kingman
Lake Mead National Recreation Area
Lake Mead
Hoover Dam
Boulder City
Las Vegas
Henderson
North Las Vegas
Nellis Air Force Base
Nellis Air Force Range
Desert National Wildlife Range
Desert National Wildlife Refuge
Creech Air Force Base
Tonopah
Goldfield
Beatty
Death Valley National Park
Furnace Creek
Stovepipe Wells
Panamint Springs
Ridgecrest
China Lake Naval Weapons Center
Inyokern
Trona
Searles Lake
Owens Lake
Owens Valley
Bishop
Big Pine
Independence
Lone Pine
Mount Whitney
Sequoia National Park
Kings Canyon National Park
Giant Forest
Grant Grove
Cedar Grove
Kings Canyon
Sequoia National Forest
Hume Lake
Dunlap
Shaver Lake
Huntington Lake
Mammoth Lakes
June Lake
Mono Lake
Yosemite National Park
Yosemite Valley
Tuolumne Meadows
Hetch Hetchy Reservoir
Hetch Hetchy
Lake Tahoe
South Lake Tahoe
Stateline
Carson City
Virginia City
Reno
Sparks
Fallon
Fallon Naval Air Station
Lahontan Reservoir
Lovelock
Winnemucca
Battle Mountain
Austin
Eureka
Ely
Great Basin National Park
Wheeler Peak
Baker
Lehman Caves National Monument
Wendover
Wendover Air Force Base
Bonneville Salt Flats
Salt Lake City
Provo
Orem
Ogden
Logan
Brigham City
Tooele
Tooele Army Depot
Dugway Proving Ground
Dugway
Delta
Fillmore
Richfield
Salina
Manti
Ephraim
Gunnison
Nephi
Spanish Fork
Price
Helper
Castle Dale
Huntington
Emery
Green River
Moab
Arches National Park
Canyonlands National Park
Needles
Island in the Sky
Dead Horse Point State Park
Natural Bridges National Monument
Hovenweep National Monument
Blanding
Monticello
Bluff
Mexican Hat
Valley of the Gods
Goosenecks State Park
Lake Powell
Page
Glen Canyon Dam
Glen Canyon National Recreation Area
Vernal
Dinosaur National Monument
Jensen
Roosevelt
Duchesne
Myton
Fruitland
Manila
Flaming Gorge National Recreation Area
Flaming Gorge Reservoir
Flaming Gorge
Green River
Rock Springs
Green River
Wyoming
Kemmerer
Diamondville
Cokeville
Evanston
Lyman
Mountain View
Bridger Valley
Fort Bridger
Uinta
Uinta Mountains
Kamas
Heber City
Park City
Wasatch
Wasatch Mountains
Wasatch Range
Wasatch National Forest
Uinta National Forest
Ashley National Forest
Manti-La Sal National Forest
Dixie National Forest
Fishlake National Forest
Humboldt-Toiyabe National Forest
Toiyabe National Forest
Inyo National Forest
Sierra Nevada
Sierra Nevada Mountains
Great Basin
Great Basin Desert
Mojave Desert
Colorado Desert
Sonoran Desert
Painted Desert
Navajo Desert
Navajo Reservation
Navajo Indian Reservation
Hopi Reservation
Hopi Indian Reservation
Hopi Mesas
Black Mesa
Mesa Verde
Mesa Verde National Park
Chuska Mountains
Carrizo Mountains
Lukachukai Mountains
Lukachukai
Ganado
Window Rock
Navajo Nation
Navajo Tribal Utility Authority
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Four Corners Monument
Shiprock
Shiprock Peak
Ship Rock
Chaco Culture National Historical Park
Chaco Canyon
Aztec Ruins National Monument
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Gallup
Zuni
Zuni Reservation
Zuni Pueblo
Acoma Pueblo
Laguna Pueblo
Laguna
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Cibola National Forest
El Malpais National Monument
El Malpais National Conservation Area
El Morro National Monument
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Ramah
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Datil Mountains
Datil
Socorro
Magdalena
Magdalena Mountains
San Mateo Mountains
San Mateo
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Mount Taylor Volcanic Field
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Cebolleta
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Rio Rancho
Bernalillo
Bernalillo County
Sandia Mountains
Sandia Peak
Sandia Crest
Sandia Pueblo
Sandia Indian Reservation
Isleta Pueblo
Isleta Indian Reservation
Isleta
Los Lunas
Los Lunas Volcano
Los Lunas Volcanic Field
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Albuquerque Air Traffic Control Tower
Albuquerque Air Route Traffic Control Center
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Albuquerque Air Route Traffic Control Center Radio Transmitter Antenna
Albuquerque Air Route Traffic Control Center Radio Receiver Antenna
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Albuquerque Air Route Traffic Control Center Radio Receiver Antenna Array Tower Guy Wire Anchor Block
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Albuquerque Air Route Traffic Control Center Radio Receiver Antenna Array Tower Guy Wire Anchor Block Concrete Reinforced Steel
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Albuquerque Air Route Traffic Control Center Radio Receiver Antenna Array Tower Guy Wire Anchor Block Concrete Reinforced Steel Rebar
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COLORADO MAP INDEX

Population

2,423,000 . Estimate. 1975
2,207,259 . . Census. . 1970
1,753,947 . . . . . " 1960
1,325,089 . . . . . " 1950
1,123,296 . . . . . " 1940
1,035,791 . . . . . " 1930
939,629 . . . . . " 1920
799,024 . . . . . " 1910
539,700 . . . . . " 1900
413,249 . . . . . " 1890
194,327 . . . . . " 1880
39,864 . . . . . " 1870
34,277 . . . . . " 1860

Metropolitan Areas

Colorado Springs 239,288
Denver-Boulder 1,239,477
Pueblo 118,238

Counties

Adams . . . 185,789 . . D 13
Alamosa . . . 11,422 . . I 10
Arapahoe . 162,142 . . E 12
Archuleta . . . 2,733 . . J 8
Baca . . . . . 5,674 . . I 15
Bent . . . . . 6,493 . . H 15
Boulder . . . 131,889 . . D 11
Chaffee . . . . 10,162 . . G 10
Cheyenne . . . 2,396 . . F 15
Clear Creek . 4,819 . . E 10
Conejos . . . . . 7,846 . . J 10
Costilla . . . . . 3,091 . . I 11
Crowley . . . . . 3,086 . . G 13
Custer . . . . . 1,120 . . H 11
Delta . . . . . 15,286 . . F 7
Denver . . . . 514,678 . . D 11
Dolores . . . . . 1,641 . . H 6
Douglas . . . . . 8,407 . . E 12
Eagle . . . . . 7,498 . . D 9
Elbert . . . . . 3,903 . . E 13
El Paso . . . 235,972 . . F 12
Fremont . . . 21,942 . . G 11
Garfield . . . 14,821 . . E 6
Gilpin . . . . . 1,272 . . D 10
Grand . . . . . 4,107 . . D 10
Gunnison . . . . 7,578 . . F 8
Hinsdale . . . . 202 . . H 8
Huerfano . . . . 6,590 . . I 11
Jackson . . . . . 1,811 . . C 9
Jefferson . . 235,300 . . E 11
Kiowa . . . . . 2,029 . . G 15
Kit Carson . . 7,530 . . E 15
Lake . . . . . 8,282 . . F 9
La Plata . . . 19,199 . . I 7
Larimer . . . . 89,900 . . C 11
Las Animas 15,744 . . I 13
Lincoln . . . . . 4,836 . . F 14
Logan . . . . . 18,852 . . B 15
Mesa . . . . . 54,374 . . F 6
Mineral . . . . . 786 . . I 8
Moffat . . . . . 6,525 . . C 6
Montezuma . 12,952 . . I 6
Montrose . . . 18,366 . . G 6
Morgan . . . . 20,105 . . D 13
Otero . . . . . 23,523 . . H 13
Ouray . . . . . 1,546 . . H 7
Park . . . . . 2,185 . . F 10
Phillips . . . . . 4,131 . . C 16
Pitkin . . . . . 6,185 . . F 8
Prowers . . . 13,258 . . H 16
Pueblo . . . . 118,238 . . H 12
Rio Blanco . . 4,842 . . D 6
Rio Grande 10,494 . . I 9
Routt . . . . . 6,592 . . C 8
Saguache . . . 3,827 . . G 9
San Juan . . . . 831 . . I 7
San Miguel . . 1,949 . . H 6
Sedgwick . . . . 3,405 . . B 15
Summit . . . . . 2,665 . . D 10
Teller . . . . . 3,316 . . F 11
Washington . 5,550 . . D 14
Weld . . . . . 89,297 . . C 12
Yuma . . . . . 8,544 . . D 15

Cities and Towns

Agate . . . . . E 13
Aguilar . . . . . 699 . . I 12
Akron . . . . . 1,775 . D 14
Alamosa . . . . 6,985 . I 10
Alamosa East* . . . . . 1,040 . . I 10
Allenspark . . . . . E 1
Allison . . . . . J 7
Alma . . . . . 73 . . E 10
Almont . . . . . G 8
Amherst . . . . . B 16
Anton . . . . . D 14
Antonito . . . . 1,113 . . J 10
Applewood* . 8,214 . . D 11
Arapahoe . . . . . F 16
Arboles . . . . . J 7
Arriba . . . . . 254 . . E 14
Arvada . . . . 49,083 . . G 3
Aspen . . . . . 2,437 . F 9
Aspen Park . . . . . H 2
Ault . . . . . 841 . . D 4
Aurora . . . . . 74,974 . . G 3
Austin . . . . . 1,163 . . F 7
Avondale . . . . . H 13
Axial . . . . . C 7
Bailey . . . . . I 1
Barr Lake . . . . . F 4
Basalt . . . . . 419 . . E 8
Baxterville . . . . . I 9
Bayfield . . . . . 320 . . J 7
Bellvue . . . . . D 2
Bennett . . . . . 613 . . D 12
Berthoud . . . 1,446 . . E 3
Bethune . . . . . 99 . . E 16
Beulah . . . . . H 11
Black Forest . . . . . J 4
Black Hawk . . 217 . . G 1
Blanca . . . . . 212 . . I 11
Blue Mountain . . . . . C 5
Blue River . . . . . 8 . . E 10
Bonanza . . . . . 10 . . G 10
Boncarbo . . . . . J 12
Bond . . . . . D 9
Boone . . . . . 448 . . H 13
Boulder . . . . 66,870 . D 11
Bow Mar* . . . . 945 . . H 3
Bowie . . . . . F 7
Boyero . . . . . F 14
Brandon . . . . . G 16
Branson . . . . . 70 . . J 13
Breckenridge . 548 . E 10
Briggsdale . . . . . C 13
Brighton . . . . 8,309 . F 4
Bristol . . . . . H 16
Broadmoor . . . . . K 3
Brookside . . . . . 173 . . G 11
Brookvale . . . . . H 2
Broomfield . . 7,261 . . G 3
Brush . . . . . 3,377 . . C 14
Buckingham . . . . . C 13
Buena Vista . 1,962 . . F 10
Buffalo Creek . . . . . I 2
Buford . . . . . D 7
Buick . . . . . E 13
Burlington . . 2,828 . E 16
Burns . . . . . D 8
Byers . . . . . D 13
Caddoa . . . . . H 15
Cahone . . . . . I 5
Calhan . . . . . 465 . . F 13
Cameo . . . . . F 6
Camp Bird . . . . . H 7
Campion . . . . . E 3
Campo . . . . . 206 . . J 16
Canfield . . . . . F 3
Canon City . 9,206 . G 11
Capulin . . . . . J 10
Carbondale . . . 726 . . E 8
Cardiff . . . . . E 8
Cascade . . . . . K 3
Castle Rock 1,531 . I 3
Cedaredge . . . . 581 . . F 7
Cedarwood . . . . . H 12
Center . . . . . 1,470 . . I 10
Central City . . 228 . G 1
Chama . . . . . J 11
Cheraw . . . . . 129 . . H 14
Cherry Hills Village . . . . 4,605 . . H 3
Cheyenne Wells . . . . . 982 . F 16
Chimney Rock . . . . . J 8
Chipita Park . . . . . K 3
Chivington . . . . . G 15
Chromo . . . . . J 9
Cimarron . . . . . G 7
Clark . . . . . B 8
Clifton . . . . . F 6
Climax . . . . . E 10
Coal Creek . . . 225 . . G 11
Coaldale . . . . . G 10
Coalmont . . . . . C 9
Cokedale . . . . . 101 . . J 12
Collbran . . . . . 225 . . E 7
Colona . . . . . G 7
Colorado Springs . 135,060 . F 12
Columbine . . . . . B 8
Columbine Valley . . . . . 481 . . H 3
Commerce City . . . . . 17,407 . . G 3
Como . . . . . E 10
Conejos . . . . . J 10
Cope . . . . . E 15
Copperdale . . . . . G 2
Cortez . . . . . 6,032 . I 6
Cotopaxi . . . . . G 10
Cowdrey . . . . . B 9
Craig . . . . . 4,205 . C 7
Crawford . . . . . 171 . . G 7
Creede . . . . . 653 . O H 8
Crested Butte . 372 . . F 8
Crestone . . . . . 34 . . H 10
Cripple Creek . 425 . F 11
Crook . . . . . 199 . . B 15
Crowley . . . . . 216 . . H 13
Cuchara . . . . . I 11
Dacono . . . . . 360 . . F 3
Dailey . . . . . B 15
De Beque . . . . . 155 . . E 6
Deckers . . . . . I 2
Deer Trail . . . . 374 . . E 13
Delhi . . . . . I 13
Del Norte . . . 1,569 . I 9
Delta . . . . . 3,694 . F 7
Denver . . . . 514,678 . D 11
Deora . . . . . I 15
Derby . . . . . 10,206 . . G 3
Dillon . . . . . 182 . . E 10
Dinosaur . . . . . 247 . . C 5
Divide . . . . . K 2
Dolores . . . . . 820 . . I 6
Dove Creek . . . 619 . H 5
Doyleville . . . . . G 9
Drake . . . . . D 2
Durango . . . 10,333 . I 7
Eads . . . . . 795 . O G 15
Eagle . . . . . 790 . E 9
East Canon . 1,805 . . G 11
East Portal . . . . . G 1
Eastlake . . . . . F 3
Eaton . . . . . 1,389 . . D 4
Echo Lake . . . . . H 1
Eckley . . . . . 193 . . D 15
Edgewater . . 4,910 . . G 3
Edler . . . . . J 15
Edwards . . . . . E 9
Egnar . . . . . H 5
Elbert . . . . . F 12
Eldora . . . . . F 1
Eldorado Springs . . . F 2
Elizabeth . . . . . 493 . . I 4
Elk Springs . . . . . C 6
Ellicott . . . . . F 12
Empire . . . . . 249 . . G 1
Englewood . 33,695 . . H 3
Erie . . . . . 1,090 . . F 3
Estabrook . . . . . I 2
Estes Park . . 1,616 . . E 1
Eureka . . . . . H 7
Evans . . . . . 2,570 . . E 4
Evergreen . . . 2,321 . . H 2
Fairplay . . . . . 419 . O E 10
Falcon . . . . . F 12
Farisita . . . . . I 11
Federal Heights* . . 1,502 . . G 3
Firestone . . . . . 570 . . F 3
Flagler . . . . . 615 . . E 15
Fleming . . . . . 349 . . B 15
Florence . . . . 2,846 . . G 11
Florissant . . . . . K 2
Fort Carson* 19,399 . . G 12
Fort Collins 43,337 . O C 11
Fort Collins West* . . . . . 1,693 . . D 3
Fort Garland . . . . . I 11
Fort Lupton 2,489 . . F 4
Fort Lyon . . . . . H 15
Fort Morgan 7,594 . O C 13
Fountain . . . . 3,515 . . G 12
Fowler . . . . . 1,241 . . H 13
Franktown . . . . . I 4
Fraser . . . . . 221 . . D 10
Frederick . . . . . 696 . . F 3
Freshwater . . . . 24 . . K 1
Frisco . . . . . 471 . . E 10
Fruita . . . . . 1,822 . . F 5
Fruitvale . . . . . F 6
Galeton . . . . . D 4
Garcia . . . . . J 11
Garden City . . 142 . . E 4
Gardner . . . . . H 11
Garfield . . . . . G 9
Gateway . . . . . G 5
Gem Village . . . . . J 7
Genoa . . . . . 161 . . E 14
Georgetown . . . 542 . O G 1
Gilcrest . . . . . 382 . . E 4
Gilman . . . . . E 9
Glade Park . . . . . F 5
Glen Haven . . . . . D 2
Glendale* . . . . 765 . . G 3
Glendevey . . . . . B 10
Glenisle . . . . . I 1
Glenwood Springs . . . 4,106 . O E 8
Golden . . . . . 9,817 . O G 2
Goodrich . . . . . C 13
Gould . . . . . C 10
Granada . . . . . 551 . . H 16
Granby . . . . . 554 . . D 10
Grand Junction . 20,170 . O F 6
Grand Lake . . 189 . . C 10
Grand Valley . 270 . . E 7
Granite . . . . . F 9
Grant . . . . . H 1
Great Divide . . . . . B 7
Greeley . . . . 38,902 . O C 12
Green Mountain Falls . . . . . 359 . . K 3
Greenwood Village . . . . 3,095 . . H 3
Greystone . . . . . C 6
Grover . . . . . 121 . . B 13
Gunnison . . . 4,613 . O G 8
Gypsum . . . . . 420 . . E 8
Hamilton . . . . . C 7
Hartman . . . . . 129 . . H 16
Hartsel . . . . . F 10
Hasty . . . . . H 15
Haswell . . . . . 135 . . G 14
Haxtun . . . . . 899 . . C 15
Hayden . . . . . 763 . . C 8

COLORADO / *People*

The 1970 United States census reported that Colorado had 2,207,259 persons. The population had increased 26 per cent over the 1960 figure, 1,753,947. The U.S. Bureau of the Census estimated that by 1975 the state's population had reached 2,423,000.

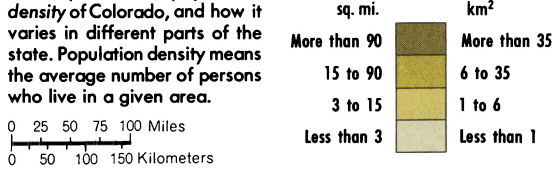
About three of every four Coloradans live in one of the state's three Standard Metropolitan Statistical Areas—Colorado Springs, Denver-Boulder, and Pueblo (see METROPOLITAN AREA). For their populations, see the *Index* to the political map of Colorado.

Most of Colorado's cities grew up near the eastern edge of the mountains. Denver, the largest city, is a business, financial, and manufacturing center. Colorado Springs attracts many tourists, and serves several military bases, including the U.S. Air Force Academy. Pueblo has large steel mills. The largest city in western Colorado is Grand Junction. See the articles on the cities of Colorado listed in the *Related Articles* at the end of this article.

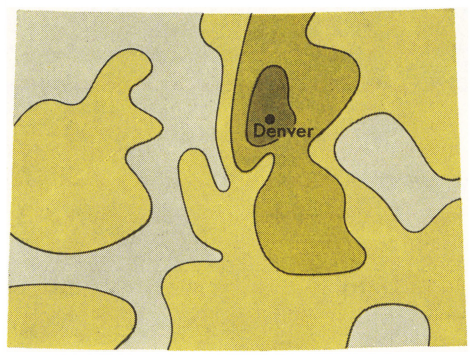
Most of Colorado's people are Protestants, but Roman Catholics form the largest religious group. Other large groups include Baptists, Methodists, Presbyterians, and members of the United Church of Christ.

POPULATION

This map shows the *population density* of Colorado, and how it varies in different parts of the state. Population density means the average number of persons who live in a given area.



WORLD BOOK map



Heeney .....D 9
Henderson .....G 3
Hereford .....B 13
Hesperus .....J 7
Hiawatha .....B 6
Hideaway Park .....D 10
Hillrose .....121..C 14
Hillside .....G 10
Hoehne .....J 13
Holly .....993..H 16
Holyoke .....1,640.°C 16
Hooper .....80..I 10
Hot Sulphur Springs .....220.°D 10
Hotchkiss .....507..F 7
Howard .....G 10
Hoyt .....D 13
Hudson .....518..F 4
Hugo .....759.°F 14
Hygiene .....E 2
Idaho Springs ...2,003..G 1
Idalia .....D 16
Ignacio .....613..J 7
Iliff .....193..B 15
Indian Agency .....J 7
Ironton .....H 7
Ivywild .....K 4
Jamestown .....185..F 2
Jansen .....J 12
Jaroso .....J 10
Jefferson .....E 10
Joes .....E 15
Johnstown ..1,191..E 3
Juanita .....J 8
Julesburg ...1,578.°B 16
Karval .....F 14
Keenesburg ...427..D 12
Keota .....6..B 13
Kersey .....474..C 12
Kim .....J 14
Kings Canyon .....B 9
Kiowa .....235.°E 12
Kirk .....E 15
Kit Carson ...220..F 15
Kittredge .....H 2
Kremmling ....764..D 9
Kutch .....F 13
Lafayette ...3,498..F 3
La Garita .....H 9
Laird .....D 16
La Jara .....768..J 10
La Junta ...7,938.°H 14
Lake City .....91.°H 8
Lake George .....J 2
Lakeside .....17..G 3
Lakewood ..92,743..G 3
Lamar .....7,797.°H 15
Laporte .....D 3
Larkspur .....I 3
La Salle ....1,227..E 4
Las Animas ...3,148.°H 14
La Sauses .....J 10
Las Mesitas .....J 10
La Veta .....589..I 11
Lawson .....G 1
Lazear .....F 7
Leadville ...4,314.°E 9
Leadville North* ....1,717..F 9
Lewis .....I 5
Liberty Bell Village .H 7
Lime .....H 12
Limon .....1,814..E 14
Lincoln Park .....2,984..G 11
Lindon .....D 14
Littleton ...26,466.°H 3
Littleton South-east* ....22,899..E 11
Livermore .....B 11
Log Lane Village .....329..C 13
Loma .....F 5
Long Park .....G 5
Longmont ..23,209..F 3
Longview .....I 2
Louisville ...2,409..F 3
Louviers .....H 3
Loveland ..16,220..E 3
Lucerne .....D 4
Ludlow .....I 12
Lycan .....I 16
Lyons .....958..E 2
Mack .....E 5
Maher .....G 7
Manassa .....814..J 10
Mancos .....709..I 6
Manitou Springs ...4,278..K 3
Manzanola ....451..H 13
Marble .....F 8
Marvel .....J 6
Masonville .....D 2
Matheson .....F 13
Maybell .....C 7
Mayday .....I 6
Maysville .....G 10
McClave .....H 15
McCoy .....D 9
Mead .....195..E 3
Meeker ....1,597.°D 7
Meeker Park .....E 1
Meredith .....E 9
Merino .....260..C 14
Mesa .....F 6
Mesita .....J 11
Milliken .....702..E 3
Milner .....C 8
Minturn .....706..E 9
Model .....I 13
Moffat .....98..H 10
Mogote .....J 10
Molina .....F 7
Monte Vista 3,909..I 10
Montezuma .....6..E 10
Montrose ....6,496.°G 7
Monument ....393..J 3
Morrison* ....439..H 2
Mosca .....I 10
Mountain View .....706..G 3
Nathrop .....G 10
Naturita .....820..H 6
Nederland ....492..F 1
New Castle ...499..E 7
Niwot .....F 2
Norfolk .....B 11
North Avondale ....G 13
North La Junta .....1,249..H 14
Northglenn .27,937..G 3
Norwood .....408..H 6
Nucla .....949..G 6
Nunn .....269..B 12
Oak Creek ....492..C 8
Ohio .....G 9
Olathe .....756..G 7
Oliver .....F 8
Olney Springs .264..H 13
Ophir* .....6..H 7
Orchard .....C 13
Orchard City .....F 7
Orchard Mesa* ....5,824..F 6
Ordway .....1,017.°H 14
Ortiz .....J 10
Otis .....521..D 15
Ouray .....741.°H 7
Ovid .....463..B 16
Padroni .....B 14
Pagosa Junction ...J 8
Pagosa Springs ...1,360.°J 8
Palisade .....874..F 6
Palmer Lake .947..J 3
Pando .....E 9
Pandora .....H 7
Paoli .....52..C 15
Paonia .....1,161..F 7
Paradox .....G 5
Parkdale .....G 11
Parker .....H 4
Parlin .....G 9
Parshall .....D 10
Peetz .....186..B 14
Penrose .....G 11
Peyton .....F 12
Phippsburg .....C 8
Pierce .....452..D 4
Pine .....I 2
Pinecliffe .....F 2
Pitkin .....44..G 9
Placerville .....H 7
Plateau City .....E 7
Platner .....D 15
Platoro .....I 9
Platteville ....683..E 4
Pleasant View .....I 5
Poncha Springs .....198..G 10
Portland .....G 11
Portland* .....24..H 7
Powder Wash .....B 6
Powderhorn .....G 8
Pritchett .....170..I 15
Proctor .....B 15
Prospect Heights* ....38..G 11
Pueblo ....97,453.°H 12
Radium .....D 9
Ramah .....101..F 13
Rand .....C 10
Range .....D 8
Rangely ....1,591..D 5
Raymer .....68..C 13
Recen .....E 10
Red Cliff .....621..E 9
Red Feather Lakes .B 11
Redmesa .....J 6
Redstone .....E 8
Redvale .....H 6
Rico .....275..I 7
Ridgway .....262..H 7
Rifle .....2,150..E 7
Riverside .....H 3
Rockvale ....359..G 11
Rocky Ford .4,859..H 14
Roggen .....D 12
Rollinsville .....G 1
Romeo .....352..J 10
Rosedale .....66..E 4
Roswell .....K 4
Rush .....F 13
Rye .....207..H 12
Saguache ....642.°H 10
Salida .....4,355.°G 10
San Acacio .....J 11
San Juan .....J 12
San Luis ....781.°J 11
San Pedra .....J 11
Sanford .....638..J 10
Sargents .....G 9
Sawpit .....26..H 7
Security [-Wide-field] ....15,297..K 4
Sedalia .....H 3
Sedgwick .....208..B 15
Segundo .....J 12
Seibert .....192..E 15
Severance .....59..D 3
Shamballah Ashrama .....I 3
Shawnee .....I 1
Sheridan ....4,787..H 3
Sheridan Lake .86..G 16
Sherrel-wood* ....18,868..D 12
Silt .....434..E 7
Silver Cliff ....126..H 11
Silver Plume ....164..G 1
Silver Springs .....H 2
Silverthorne ...400..D 10
Silverton .....797.°H 7
Simla .....460..F 13
Slick Rock .....H 5
Snowmass .....E 8
Snyder .....C 14
Somerset .....F 7
South Fork .....I 9
Springfield .1,660.°I 15
Starkville .....166..J 12
Steamboat Springs ...2,524.°C 9
Sterling ....10,636.°C 14
Stone City .....G 12
Stoneham .....C 14
Stonewall .....J 11
Stonington .....I 16
Strasburg .....D 13
Stratton .....790..E 15
Stratton Meadows* .6,223..F 12
Stringtown .....E 9
Sugar City ....307..H 14
Summitville .....I 9
Superior .....171..F 2
Swink .....381..H 14
Tabernash .....D 10
Tarryall .....J 1
Telluride .....553.°H 7
Texas Creek .....G 11
Thatcher .....I 13
Thornton ..13,326..G 3
Tiffany .....J 7
Timnath .....177..D 3
Timpas .....H 14
Toponas .....D 9
Towaoc .....J 5
Towner .....G 16
Trinchera .....J 13
Trinidad ....9,901.°J 12
Twin Lakes .....F 9
Two Buttes ...138..I 16
Tyrone .....I 13
Uravan .....G 5
Utleyville .....I 15
Vail .....484..E 9
Vallecito .....I 7
Vancorum .....H 6
Vernon .....D 16
Victor .....258..G 11
Vilas .....83..I 16
Villa Grove .....G 10
Villegreen .....I 14
Virginia Dale .....B 11
Vona .....114..E 15
Walden .....907.°B 9
Walsenburg .4,329.°I 12
Walsh .....989..I 16
Ward .....32..F 1
Wattenberg .....F 3
Welby* .....6,875..D 12
Weldona .....C 13
Wellington ...691..B 11
Westcliffe ...243.°H 11
Westminster 19,432..G 3
Westminster East* ....7,576..D 12
Weston .....J 12
Wetmore .....H 11
Wheat Ridge 29,778..G 3
Whitewater .....F 6
Widefield, see Security [-Wide-field]
Wiggins .....C 13
Wild Horse .....F 15
Wiley .....357..H 15
Williamsburg ..75..G 11
Windsor ....1,564..D 3
Winter Park .....G 1
Wolcott .....E 9
Wondervu .....F 2
Woodland Acres ...H 12
Woodland Park .....1,022..J 3
Woodrow .....D 14
Woody Creek .....E 8
Wray .....1,953.°D 16
Yampa .....286..D 8
Yellow Jacket .....I 5
Yoder .....F 13
Yuma .....2,259..D 15

*Does not appear on the map; key shows general location.
°County seat.

Source: Latest census figures (1970 and special census). Places without population figures are unincorporated areas and are not listed in census reports.

COLORADO / *Education*

Schools. The first school in Colorado was opened in 1859 by O. J. Goldrick. His students were the children of gold miners in the Cherry Creek area (now Denver). Today, the state department of education is headed by a five-member board of education. Board members are elected to six-year terms. They appoint a commissioner of education to direct the department. Local districts are run by elected school boards and appointed superintendents. Children in Colorado must attend school between the ages of 7 and 16. For the number of students and teachers in Colorado, see EDUCATION (table).

Libraries. Colorado's first public library was established in Denver in 1860. Today, Colorado has about 125 public libraries, including about 25 county libraries. The Colorado State Library is located in Denver.

Museums. The Denver Art Museum features an Indian and native arts collection. The Denver Museum of Natural History has displays about animals. The Colorado State Museum in Denver has exhibits on the early West. The State Historical Society operates museums in Denver, Garland, Georgetown, Leadville, Montrose, Platteville, Pueblo, and Trinidad.

UNIVERSITIES AND COLLEGES

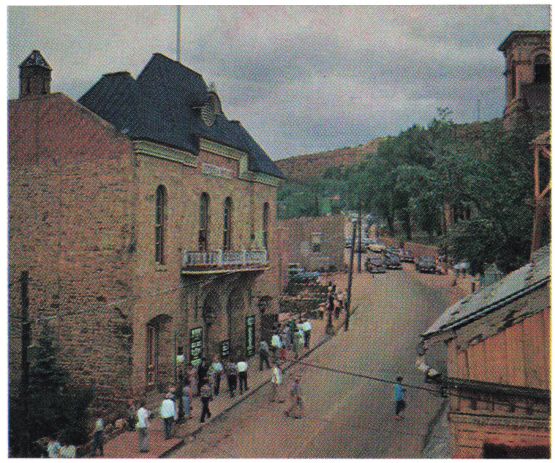
Colorado has 19 universities and colleges accredited by the North Central Association of Colleges and Secondary Schools. For enrollments and further information, see UNIVERSITIES AND COLLEGES (table).

Name	Location	Founded
Adams State College	Alamosa	1921
Colorado, University of	*	*
Colorado College	Colorado Springs	1874
Colorado School of Mines	Golden	1874
Colorado State University	Fort Collins	1870
Colorado Women's College	Denver	1888
Conservative Baptist Theological Seminary	Denver	1950
Denver, University of	Denver	1864
Fort Lewis College	Durango	1911
Iliff School of Theology	Denver	1973
Loretto Heights College	Denver	1918
Mesa College	Grand Junction	1974
Metropolitan State College	Denver	1967
Northern Colorado, University of	Greeley	1889
Regis College	Denver	1887
St. Thomas Seminary	Denver	1906
Southern Colorado State College	Pueblo	1963
United States Air Force Academy	Colorado Springs	1954
Western State College of Colorado	Gunnison	1901

*For campuses and founding dates, see UNIVERSITIES AND COLLEGES (table).

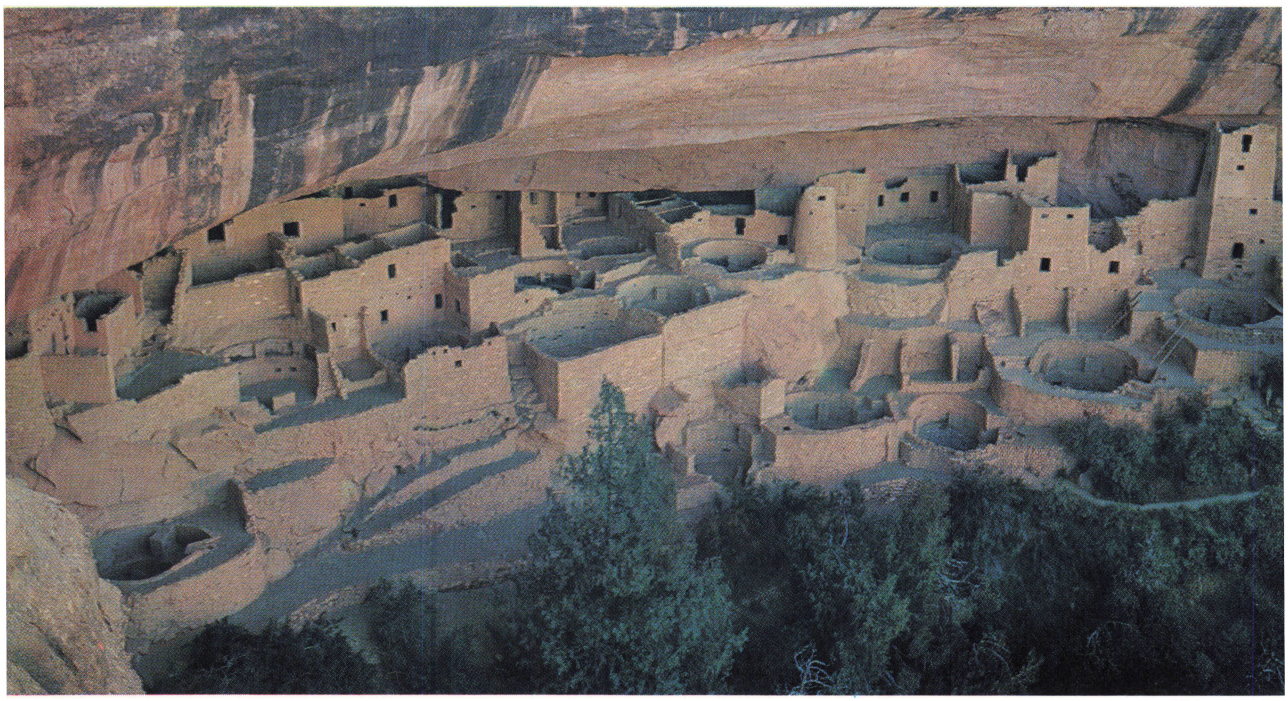
COLORADO / *A Visitor's Guide*

Beautiful Colorado attracts about 8 million tourists a year. In summer, visitors enjoy the state's cool climate. Campers pitch their tents on forested mountain slopes or near beautiful mountain streams. High peaks test the skill of mountain climbers. Old mining towns and Indian cliff dwellings lure tourists interested in history. Fishermen cast for trout in the clear, swift streams. In autumn, hunters search for deer and other big game. In winter, skiers visit such famous resorts as Aspen, Arapahoe Basin, Vail, and Winter Park. The ski season lasts from late November to April.



Fred M. Mazzulla

Opera House in Central City



Glen Fishback

Ancient Cliff Dwellings in Mesa Verde National Park near Cortez

PLACES TO VISIT

Following are brief descriptions of some of Colorado's many interesting places to visit.

Air Force Academy, north of Colorado Springs, trains the nation's air force officers. The Visitors Center at the south entrance shows films about the academy.

Bent's Fort, east of La Junta, was an early outpost for trappers. The old fort is a national historic site. A museum in La Junta features a model of the fort.

Buffalo Bill's Grave, on top of Lookout Mountain near Golden, honors the famous scout and showman William F. Cody (see BUFFALO BILL).

Central City, once a rich gold camp, is now a summer resort. A theater and music festival is held each summer in the old-time opera house.

Garden of the Gods, near Colorado Springs, is a breathtaking cluster of huge red sandstone rocks. Thousands of worshipers gather there on Easter Sunday for sunrise services. See GARDEN OF THE GODS.

Narrow Gauge Railroad, between Durango and Silverton, is the last passenger railroad of its type in the country. The tracks are set closer together than modern ones. Summer visitors can take a 90-mile (140-kilometer) round trip through beautiful canyons.

Pikes Peak, west of Colorado Springs, is probably the most famous mountain in the Rockies, even though 30 Colorado peaks are higher. Visitors can reach the top of the mountain by automobile toll road, cog railway, on horseback, or on foot. See PIKES PEAK.

Royal Gorge, near Canon City, is a massive canyon cut by the Arkansas River. The gorge, more than 1,000 feet (300 meters) deep, is crossed by the world's highest suspension bridge. See ROYAL GORGE.

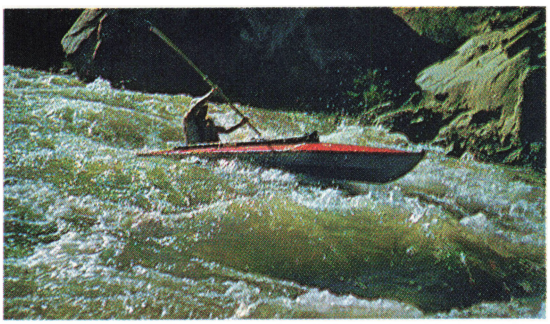
Many Colorado cities and towns hold fairs and rodeos during the summer. Probably the outstanding event is the weeklong Colorado State Fair. It attracts thousands of visitors to Pueblo in August.

Many art, business, education, and religious groups hold meetings in Colorado each year. The Aspen Institute for Humanistic Studies sponsors many conferences. Estes Park is a popular location for meetings. Other outstanding annual events in Colorado include the following.

January-April: National Western Stock Show in Denver (January); Winter Carnival in Steamboat Springs (February); Easter Sunday Sunrise Services in the Garden of the Gods near Colorado Springs, and in Red Rocks Park near Denver.

May-August: Boat races near Salida (June); Pikes Peak Auto Race (early July); Rodeo in Greeley (first week in July); Entertainment Festival in Central City (July and August); Aspen Music Festival (July and August); Rodeo in Monte Vista (late August); Pikes Peak or Bust Rodeo in Colorado Springs (August).

September-December: Rodeos in Durango and Rocky Ford (early September); New Year's Eve fireworks on Pikes Peak.

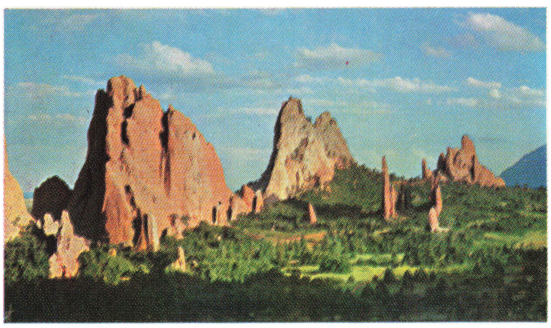


Margaret Durrance, Photo Researchers

Boat Races in the Rapids near Salida

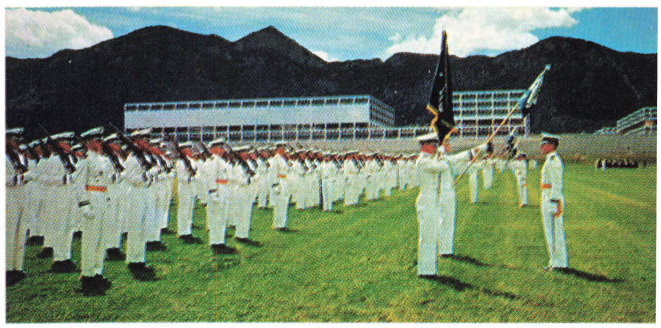
Ragsdale, FPG

Pikes Peak Overlooks the Highway Through Ute Pass



Glen Fishback

Garden of the Gods near Colorado Springs



Ronny Jaques, Photo Researchers

United States Air Force Academy at Colorado Springs

U.S. Mint, in Denver, makes millions of coins each year. Tours of the mint are given. See MINT.

National Parks, Monuments, and Forests. Colorado has two national parks—Rocky Mountain and Mesa Verde. Rocky Mountain National Park, in north-central Colorado, has more than 100 peaks that rise over 11,000 feet (3,350 meters). Mesa Verde National Park, near Cortez, preserves Indian cliff dwellings almost a thousand years old. See the separate articles in WORLD BOOK on each national park.

Seven other areas of scenic beauty or historical interest have been designated as national monuments. These are the Black Canyon of the Gunnison, Colorado, Dinosaur, Florissant Fossil Beds, Great Sand Dunes, Hovenweep, and Yucca House. See the separate articles on these places.

Twelve national forests cover about 13,750,000 acres (5,560,000 hectares) in Colorado. Completely within the state are Arapaho, Grand Mesa, Gunnison, Pike, Rio Grande, Roosevelt, Routt, San Isabel, San Juan, Uncompahgre, and White River national forests. Manti-LaSal forest lies partly in Utah. For the areas and chief features of each national forest, see NATIONAL FOREST (table). In 1964, Congress set aside five areas of national forest land as national wildernesses. These areas will be kept in their natural condition.

Other Parks. The city of Denver maintains many mountain parks outside its city limits. Since 1963, Colorado has created state parks on land administered by the state fish and game commission. For information about these parks, write to Director, Game, Fish, and Parks Department, 6060 Broadway, Denver, Colo. 80216.

Specially created for **World Book Encyclopedia** by Rand McNally and World Book editors

Adobe Creek .....D 7
Adobe Creek Res. ...D 7
Antero Reservoir ....C 5
Apishapa R. .....E 6
Arikaree R. .....C 8
Arkansas R. .....D 8
Badger Creek .....C 7
Banded Peak .....E 4
Battlement Mesa ...C 2
Bear Creek .....E 8
Big Sandy Creek ....D 8
Big Thompson R. ....B 5
Bijou Creek .....C 6
Bison Peak .....C 5
Black Canyon of the Gunnison Nat'l. Mon. .....D 3
Black Squirrel Creek .D 6
Blanca Peak .....E 5
Blue Mesa .....D 3
Bonny Reservoir ....C 8
Box Elder Creek ....C 6
Cache la Poudre R. .B 5
Cathedral Bluffs ....C 2
Cebolla Creek .....D 3
Cedar Creek .....B 7
Cherry Creek .....C 6
Chivington Reservoir D 8
Cimarron R. .....E 9
North Fork .....E 9
Cochetopa Creek ....D 4
Cochetopa Hills ....D 4
Colorado Nat'l. Mon. C 2
Colorado R. .....C 2
Continental Divide ..D 4
Coyote Basin .....B 2
Crestone Peak .....E 5
Crow Creek .....B 6
Cucharas R. .....E 6
Culebra Peak .....E 5
Cumbres Pass .....E 4
Danforth Hills .....B 2
Deer Peak .....D 5
Dinosaur Nat'l. Mon. B 2
Dolores R. .....D 2
Elevenmile Canyon Reservoir .....D 5
Elk Head Mts. .....B 3
Elk Mts. .....C 3
Elk R. .....B 4
Fishers Peak .....E 6
Fossil Ridge .....D 4
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Frenchman Creek ....B 8
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Horse Creek .....D 7
Horse Tooth Reservoir .....B 5
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Huerfano R. .....E 6
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John Martin Reservoir .....D 7
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Laramie R. .....A 5
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Lone Tree Creek .....B 6
Longs Peak .....B 5
Los Pinos R. .....E 3
Loveland Pass .....C 5
Medicine Bow Mts. ..A 4
Mesa de Maya (Plateau) .....E 7
Mesa Verde .....E 3
Mesa Verde Nat'l. Park .....E 2
Michigan Creek .....B 4
Milton Reservoir .....B 6
Model Reservoir .....E 6
Moffat R. R. Tunnel C 5
Monarch Pass .....D 4
Monument Peak .....C 3
Mt. Elbert (Highest Point in Colorado).C 4
Mt. Evans .....C 5
Mt. Harvard .....D 4
Mt. Lincoln .....C 4
Mt. Powell .....C 4
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Mt. Zirkel .....B 4
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North Arapaho Peak .C 5
North La Veta Pass ..E 5
North Mamm Peak ..C 3
Ohio Peak .....D 3
Pagoda Peak .....B 3
Paradox Valley .....D 2
Park Plateau .....E 6
Park Range .....B 4
Pawnee Valley .....B 7
Pikes Peak .....D 5
Platte Arkansas Divide .....C 6
Poncha Pass .....D 4
Pond Creek .....D 7
Prewitt Reservoir ...B 7
Purgatoire R. .....E 7
Rabbit Ears Pass ...B 4
Rampart Range .....C 5
Red Mountain Pass ..E 3
Red Table Mountain .C 4
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Republican R., South Fork .....C 8
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Rocky Mountain Nat'l. Park .....B 5
Rocky Mts. .....B 4
Royal Gorge .....D 5
Rush Creek .....D 7
Saddle Mountain ....D 5
Saguache Creek .....D 4
San Juan Mts. .....E 3
San Juan R. .....E 3
San Luis Lake .....E 5
San Luis Peak .....E 4
San Luis Valley .....E 4
Sanchez Reservoir ...E 5
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Sand Mountain .....B 3
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Shavano Peak .....D 4
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South Platte R. .....B 6
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Uncompahgre Mts. ..D 3
Uncompahgre Peak ..D 3
Uncompahgre Plateau .....D 2
Uncompahgre R. .....D 3
Vallecito Reservoir ..E 3
West Elk Mts. .....D 3
West Spanish Peak ..E 6
Wet Mts. .....D 5
White R. .....B 2
White River Plateau..C 3
Whitewoman Creek ..D 9
Williams Fork Mts. ..B 3
Windom Mountain ...E 3
Wolf Creek Pass ....E 4
Yampa Plateau .....B 2
Yampa R. .....B 2

COLORADO / *The Land*

Land Regions. Colorado has four main land regions: (1) the Colorado Plateau, (2) the Intermontane Basin, (3) the Rocky Mountains, and (4) the Great Plains.

The Colorado Plateau, along the western border, covers about a fifth of the state. It is an area of high hills, plateaus, deep valleys, and *mesas* (flat-topped hills with steep sides). Farmers raise a variety of crops in the valleys. During summer months, cattle and sheep graze on the grasslands of the mesas.

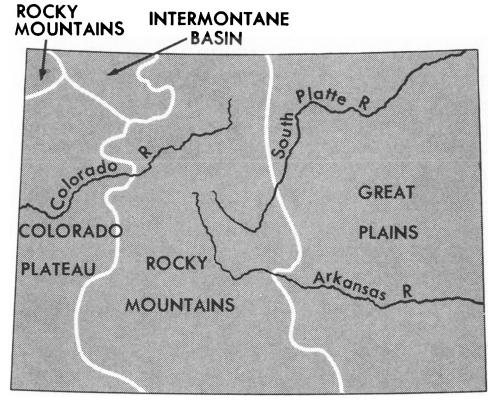
The Intermontane Basin, north of the plateau, is Colorado's smallest land region. It is a region of rolling hills and sagebrush plateaus wedged between mountain ranges near the northwest corner of the state. The word *intermontane* means *between mountains*. Herds of sheep graze on the plateaus of the region, and forests cover the hills.

The Rocky Mountains cover the middle two-fifths of Colorado. They also rise in the state's northwestern corner. The Colorado Rockies have been called the *Roof of North America* because between 50 and 60 peaks reach 14,000 feet (4,270 meters) or more above sea level. These peaks are the tallest in the entire Rocky Mountain chain, which stretches from Alaska to New Mexico.

The Continental Divide runs through the Colorado Rockies. Streams east of the divide flow into the Atlantic Ocean. Those west of it flow into the Pacific. The Colorado Rockies are one of the country's most popular areas for mountain climbing, fishing, hunting, and skiing.

The Rocky Mountains of Colorado consist of five main mountain ranges: (1) the Front Range, (2) the Park Range, (3) the Sawatch Range, (4) the San Juan Mountains, and (5) the Sangre de Cristo Mountains. The easternmost group is the Front Range, which includes Mount Evans (14,264 feet, or 4,348 meters), Longs Peak (14,255 feet, or 4,345 meters), Pikes Peak (14,110 feet, or 4,301 meters), and other mountains that rise to the west of Denver and Colorado Springs. The *Sangre de Cristo* (Blood of Christ) Mountains are just south of the Front Range. Together, the Front Range and the Sangre de Cristo Mountains form a wall that faces the Great Plains to the east.

The Park Range, west of the Front Range, stretches from a point near the Wyoming border south to the beginning of the Arkansas River. South of the Park Range is the Sawatch Range, which includes Mount Elbert



Land Regions of Colorado

(14,433 feet, or 4,399 meters), the highest peak of the Rocky Mountains. The rugged San Juan Mountains occupy southwestern Colorado.

The mountains of Colorado surround many level, almost treeless areas called *parks*. The largest of these areas include North Park, Middle Park, South Park, and the San Luis Valley. See ROCKY MOUNTAINS.

The Great Plains cover roughly the eastern two-fifths of Colorado. Colorado's Great Plains region is part of the vast Interior Plain of North America that stretches from Canada to Mexico. It slopes gently upward from east to west toward the base of the Rocky Mountains. Farmers once thought the area was too dry for farming. But irrigation projects in the valleys and dry farming on the higher lands have made large-scale agriculture possible. (see DRY FARMING; IRRIGATION).

Rivers and Lakes. More important rivers begin in Colorado than in any other state. These rivers provide water for many states. Three major tributaries of the Mississippi-Missouri river system rise on the eastern slope of the Rocky Mountains. These are the Arkansas, South Platte, and Republican rivers. West of the Rockies, the Colorado River begins at Grand Lake, flows through Middle Park, and winds southwest into Utah. The Colorado drains a twelfth of all the land of the United States. Several of the chief tributaries of the Colorado, including the Uncompahgre, Gunnison, San Juan, and Dolores rivers, also rise in the state. The Rio Grande starts in the San Juan range, and flows east and south into New Mexico. The North Platte River flows north from North Park into Wyoming.

Rivers add much to Colorado's scenic beauty. Many have carved deep gorges, or tumble down mountains in lovely waterfalls and cascades. The Royal Gorge of the Arkansas River, west of Canon City, is over 1,000 feet (300 meters) deep. A bridge 1,053 feet (321 meters) above the floor of the Royal Gorge is the highest suspension bridge in the world. In some places, the Black Canyon of the Gunnison River in western Colorado is 2,400 feet (732 meters) below the surrounding land.

Many beautiful lakes lie in the mountains. Grand Lake, formed by glaciers, covers about 600 acres (240 hectares) near the town of Grand Lake. It is Colorado's largest natural lake. Summit Lake, 12,740 feet (3,883 meters) above sea level, is one of the highest lakes in the country. Many artificial lakes have been created by damming the rushing mountain streams. John Martin Reservoir, formed by a federal flood-control project on the Arkansas River, is the largest lake. It covers more than 29 square miles (75 square kilometers) when full. The water is used for irrigation.

Independence Monument, *center,* and other unusual rock formations are part of the Colorado National Monument near Grand Junction. These scenic formations are in the Colorado Plateau region.
Alpha Photo Assoc.

Summer Wildflowers brighten a level area high in the Rocky Mountains near Boulder. The Colorado Rockies have many peaks 14,000 feet (4,270 meters) or more above sea level.
Ragsdale, FPG

The Continental Divide forms a backdrop to the moderately sloping Great Plains region near Denver. This gently rolling land ends abruptly at the base of the mighty Rocky Mountains.
Ronny Jaques, Photo Researchers

Colorado's climate is generally dry and sunny. But because of the great differences in altitude, temperatures vary widely in short distances. The mountains are almost always cooler than the plains and plateaus. Burlington, on the plains, has an average January temperature of 28° F. (−2° C). Leadville, in the mountains, has a January average of 18° F. (−8° C). Average July temperatures are 74° F. (23° C) in Burlington and 55° F. (13° C) in Leadville. Colorado's highest temperature, 118° F. (48° C), occurred at Bennett on July 11, 1888. Taylor Park Dam in Gunnison County had the lowest, −60° F. (−51° C), on Feb. 1, 1951.

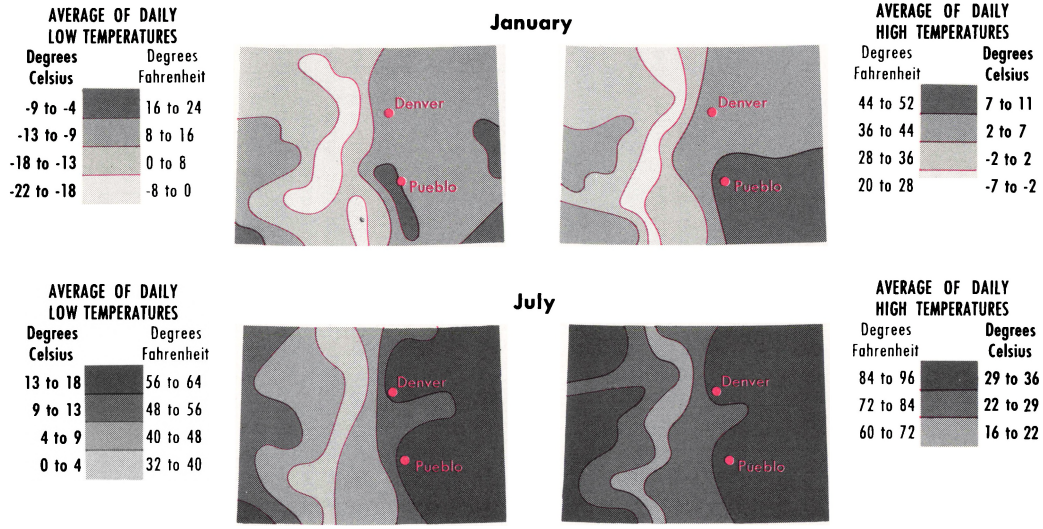
Colorado's average yearly *precipitation* (rain, melted snow, and other forms of moisture) is about 15 inches (38 centimeters). This moisture is not distributed evenly. The western slopes get the most rain and snow. The San Luis Valley, in the south, is the driest area.

The dry air makes Colorado's climate comfortable. The sun warms the thin air quickly, especially at high altitudes. The *chinook*, a warm wind that occasionally blows down the eastern slopes in winter, can raise temperatures on the plains by 20 degrees Fahrenheit (11 degrees Celsius) or more in a short time.

Brilliant Yellow Aspens Attract Autumn Visitors to resort areas near the city of Aspen. The trees are bare in winter, and bright green leaves cover the branches in summer.

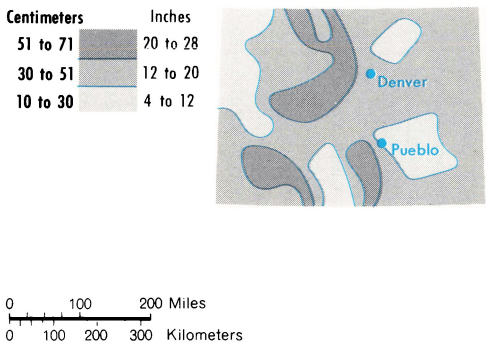
Margaret Durrance, Photo Researchers

SEASONAL TEMPERATURES



AVERAGE YEARLY PRECIPITATION

(Rain, Melted Snow and Other Moisture)



WORLD BOOK maps

AVERAGE MONTHLY WEATHER

	DENVER					PUEBLO				
	Temperatures F°		Temperatures C°		Days of Rain or Snow		Temperatures F°		Temperatures C°		Days of Rain or Snow
	High	Low	High	Low			High	Low	High	Low	
JAN.	42	16	6	-9	6	JAN.	45	14	7	-10	5
FEB.	45	19	7	-7	6	FEB.	49	19	9	-7	4
MAR.	51	25	11	-4	8	MAR.	55	25	13	-4	6
APR.	61	34	16	1	9	APR.	65	35	18	2	7
MAY	69	43	21	6	11	MAY	73	45	23	7	10
JUNE	81	52	27	11	9	JUNE	84	54	29	12	7
JULY	87	58	31	14	9	JULY	90	60	32	16	9
AUG.	85	57	29	14	8	AUG.	88	59	31	15	9
SEPT.	77	48	25	9	5	SEPT.	81	49	27	9	4
OCT.	66	37	19	3	6	OCT.	69	37	21	3	4
NOV.	53	26	12	-3	5	NOV.	55	23	13	-5	4
DEC.	45	18	7	-8	4	DEC.	47	16	8	-9	3

Colorado's economy is divided roughly along the natural lines of its land. East of the mountains lie the major manufacturing centers and the chief crop growing areas. In the mountains, many kinds of metals are mined. On the western side of the state are major grazing areas, orchards, and uranium mines. Oil occurs in places on both sides of the mountains.

The federal government and tourists play a major part in Colorado's economy. The U.S. government owns more than a third of the land in Colorado. It is an important factor in the state's economy because it controls grazing, logging, mining, and recreation on this land. Tourism ranks high as an income producer. Visitors spend more than $600 million a year in the state.

Natural Resources. Mineral deposits, a pleasant climate, rich soils, vast evergreen forests, and water are Colorado's greatest natural resources.

Soil. The soils of the eastern plains and the valleys of the western mountains are among the most fertile in the nation. These soils contain the minerals needed by growing plants. The eastern soils are brown. During years of good rainfall, they produce excellent crops. In dry years, the soil becomes powdery, and crops are poor. The high mountains and some western plateaus have thin, stony soils called *lithosols*.

Minerals. Vast deposits of coal, molybdenum, natural gas, petroleum, uranium, vanadium, and zinc help support Colorado's economy. Huge oil shale and uranium deposits offer promise of future mineral development. Supplies of building materials such as gravel, sand, and stone seem large enough for the state's future needs.

Forests. About 23 million acres (9.31 million hectares), or a third of the state, is covered by forests. But only about 12 million acres (4.9 million hectares) can be cut for commercial use. Some forests are unsuitable because they are too far from transportation or too low in quality. Others have been set aside for conservation purposes. About 9 million acres (3.6 million hectares) of the commercial forests are on U.S. government land.

Almost all the commercially valuable trees are *softwood* (evergreens suitable for construction lumber). However, Colorado imports lumber each year because not enough is produced in the state. Leading lumber trees include various kinds of firs, pines, and spruces.

Plant Life. Because of the large differences in altitude and moisture, Colorado's land has a wide variety of plant life. Plants include many kinds of cactus, greasewood, sagebrush, and yucca in the drier areas. The chief grasses are buffalo and grama grass. Spring wild flowers include buttercups, sand lilies, wild geraniums, and yarrows. Summer brings columbines, dogtooth violets, Indian paintbrushes, mountain lilies and daisies, and wild irises and roses.

Animal Life of Colorado includes about 400,000 deer, elk, and other big game animals. Pronghorn antelope live on the plains. Fur-bearing animals include bears, beavers, bobcats, foxes, martens, rabbits, and skunks. Under the dry plains, prairie dogs dig elaborate systems of tunnels. Game birds include several kinds of grouse, pheasants, and quail. Colorado game fish include bass, catfish, crappies, perch, and trout.

Water is precious in the dry West. The control of water sources is a continuing concern to the people. Six major rivers rise in Colorado. By agreement with other states, and with Mexico, Colorado cannot use more than its share of the water in these streams.

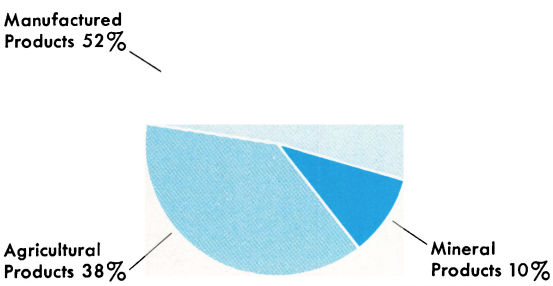
Distribution of water within the state is uneven. The *Western Slope* (the land west of the Continental Divide) covers slightly more than a third of the land area. But it gets more than two-thirds of the *surface water* (runoff from rain and snow). The *Eastern Slope*, with almost two-thirds of the land area, gets less than a third of the surface water. There have been bitter legal and political fights over water rights within the state.

Many dams and tunnels have been built for *transmountain diversion* of water. Western Slope water is brought through tunnels in the mountains for use on the dry but heavily populated Eastern Slope. Some of this water goes to homes and factories. The rest is used to irrigate the fertile soil of the plains. These projects help solve eastern Colorado's water problems. The future growth of Colorado, both in manufacturing and agriculture, depends on the amount of water available.

Manufacturing, including processing, accounts for more than half the value of all goods produced in Colorado. Goods manufactured in the state have a *value*

PRODUCTION OF GOODS IN COLORADO

Total value of goods produced in 1971—$3,978,221,000



Percentages are based on farm income, value added by manufacture, and value of mineral production.

Sources: U.S. government publications, 1971-1973.

EMPLOYMENT IN COLORADO

Total number of persons employed in 1972—857,300

	Number of Employees
Government	197,900
Wholesale & Retail Trade	190,600
Community, Business, & Personal Services	137,200
Manufacturing	122,400
Transportation & Public Utilities	54,300
Construction	49,400
Agriculture	49,100
Finance, Insurance, & Real Estate	42,900
Mining	13,500

Sources: *Employment and Earnings*, various months, 1972 & 1973, U.S. Bureau of Labor Statistics; U.S. Bureau of Employment Security.

added by manufacture of about $2 billion yearly. This figure represents the value created in products by Colorado's industries, not counting such costs as materials, supplies, and fuels.

Colorado has about 3,300 manufacturing plants, but many of them are small. About 1,000 plants have 20 or more employees. But Colorado is the leading manufacturing state in the Rocky Mountain region.

Colorado's largest manufacturing industry produces food products. Food processing accounts for about a fifth of the value added by manufacture. This industry includes more than 100 packing, processing, and shipping plants for meat. About 10 refineries make sugar from sugar beets. Over 100 plants in Colorado can or freeze foods.

Defense work is also important in Colorado. Most of the defense work takes place at the Martin Marietta Aerospace plant south of Denver and at the Dow Chemical Company plant at Rocky Flats near Boulder. Work at the Martin Marietta plant includes the production of space vehicles. The Dow plant works on nuclear energy projects for the United States government.

Other leading industries in Colorado manufacture fabricated metal products, nonelectrical machinery, and stone, clay, and glass products. Large factories make luggage, mining and electrical machinery, photographic supplies, rubber products, and steel. Printing and publishing are also important in the state.

Agriculture. Farm products in Colorado earn about $1\frac{1}{2}$ billion a year. Colorado has about 28,000 farms. They range in size from large ranches to small *truck* (vegetable) farms.

Livestock and livestock products account for about four-fifths of the value of all Colorado farm products. The state ranks among the leaders in production of sheep, but cattle raised there have a much greater dollar value. Grazing of cattle on ranches has been important for many years. Colorado farmers also *finish* (fatten) cattle in *feed lots*. Operators of feed lots put range cattle in relatively small pens. There, the cattle are fattened on special feed. They gain weight faster because they eat grain and other kinds of feed with high food value. These animals bring better prices in the market. The area around Greeley has the most feed lots. Milk ranks as one of the state's most valuable farm products.

The chief field crops, in order of importance, are wheat, corn, and sugar beets. Most of Colorado's wheat is grown on the eastern plains by dry-farming methods. Most corn is grown on the eastern plains. Sugar beets grow best on irrigated land in northern Colorado.

Colorado farmers produce a variety of vegetables. Major Colorado vegetable crops, in order of value, are dry beans, potatoes, onions, and lettuce. The potatoes are grown in the San Luis Valley of southern Colorado. Much of this valley area is irrigated with water from wells. Colorado farmers also grow high-quality celery and cantaloupes.

Other important agricultural products include flowers and fruits. Colorado carnations are sent to many other states, and have become famous for their size and beauty. Apples, peaches, and cherries grow in the western part of the state. These fruits usually grow in irrigated orchards.

Mining in Colorado produces about $400 million a year, or about 10 per cent of the value of all goods produced in the state. Petroleum, molybdenum, coal, and sand and gravel lead in value, in that order.

A feature of Colorado's mining industry is its wide distribution. Of the 63 counties, only Phillips County has no mineral production.

Petroleum accounts for about a fourth of the mining income in the state. About half the oil comes from Rio Blanco County in the northwest. Major oilfields there include the Rangely-Weber and Wilson Creek fields.

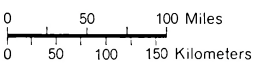
Molybdenum accounts for more than a fifth of Colorado's mining income. This metal makes steel hard and tough. It also has uses in rockets where tough, heat-resistant metal is needed. Colorado's major molybdenum deposits lie near Climax and Montezuma. These deposits, the largest known sources of molybdenum in North America, produce more than half of the U.S. supply.

Colorado coal provides fuel for electric power plants and for steel mills in Colorado, Utah, and California. Natural gas and natural gas liquids also are important products of the Colorado mining industry.

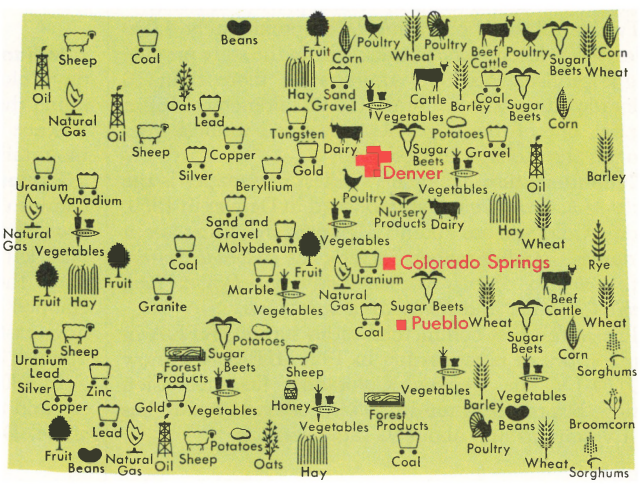
Large quantities of building materials are available

FARM, MINERAL, AND FOREST PRODUCTS

This map shows the areas where the state's leading farm, mineral, and forest products are produced. The major urban areas (shown in red) are the state's important manufacturing centers.



WORLD BOOK map



in Colorado. Colorado limestone is used in making cement. Sand and gravel are found in almost every county. Production of these basic materials totals about 30 million short tons (27 million metric tons) a year. Quarries produce several kinds of stone, including granite, limestone, marble, quartz, and sandstone.

Colorado is a leading state in uranium ore production. About 120 mines produce this ore. About 90 mines in 16 counties produce copper, gold, lead, silver, and zinc. Usually, all or most of these metals come from the same ore. Other mineral products include clay, gemstones, gypsum, lime, mica, perlite, pumice, and salt.

Colorado also has large deposits of oil shale, a source of petroleum. The shale, a type of rock, is found in northwestern Colorado. It lies on or near the surface, and can be mined with huge power shovels. Colorado has about 1½ trillion short tons (1.4 trillion metric tons) of oil shale. Oil companies have been experimenting with this shale since the 1960's. The high cost of processing remains a major obstacle to rapid development.

Electric Power. About 90 per cent of Colorado's electricity is produced by steam power, mostly from coal. Water power provides the rest. About three-fourths of the power comes from privately owned plants. Colorado's power production almost tripled in the 1950's. New dams and new steam generating plants continued to raise Colorado's power capacity during the 1970's. The state's first nuclear power plant began operating in Platteville in 1975.

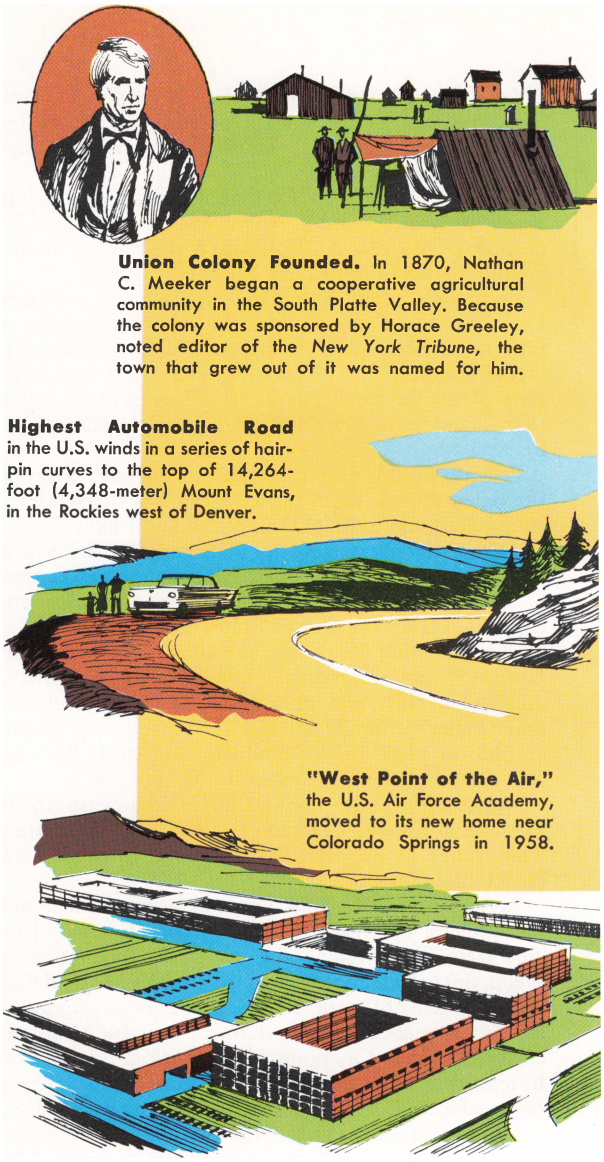
Transportation. Colorado has special transportation problems because of its mountains. The highest road in the United States climbs to the top of 14,264-foot (4,348-meter) Mount Evans near Denver. In winter, highways that cross the mountains are kept open by snowplows. Colorado has about 81,000 miles (130,000 kilometers) of roads, more than half of them surfaced. The 1.7-mile (2.7-kilometer) Eisenhower Memorial Tunnel, which opened in 1973, carries motor traffic through the Rockies at about 11,000 feet (3,400 meters) above sea level. It is the world's highest tunnel for vehicles.

Colorado has air service from eight airlines. Denver's Stapleton International Airport, the chief commercial airport, is one of the busiest fields in the United States. Colorado has about 220 public and private airports.

Twelve railroads operating on approximately 4,000 miles (6,400 kilometers) of track within the state provide freight service. Passenger trains serve more than 10 Colorado cities. The 6.23-mile (10.03-kilometer) Moffat Tunnel, one of the longest U.S. railroad tunnels, goes through the Rockies in Colorado.

Communication. Colorado's oldest newspaper is the *Rocky Mountain News*, first published in Denver in 1859. Today, Colorado has about 170 papers, including about 25 dailies. Leading papers include the *Colorado Springs Sun*, *Colorado Springs Gazette-Telegraph*, *Denver Post*, *Pueblo Chieftain*, and *Rocky Mountain News*.

The state's first commercial radio station, KFKA in Greeley, began broadcasting in 1921. KFEL-TV (now KCTO-TV) in Denver, Colorado's first television station, began operation in 1952. Today, the state has 12 TV stations and about 95 radio stations.



Union Colony Founded. In 1870, Nathan C. Meeker began a cooperative agricultural community in the South Platte Valley. Because the colony was sponsored by Horace Greeley, noted editor of the *New York Tribune*, the town that grew out of it was named for him.

Highest Automobile Road in the U.S. winds in a series of hairpin curves to the top of 14,264-foot (4,348-meter) Mount Evans, in the Rockies west of Denver.

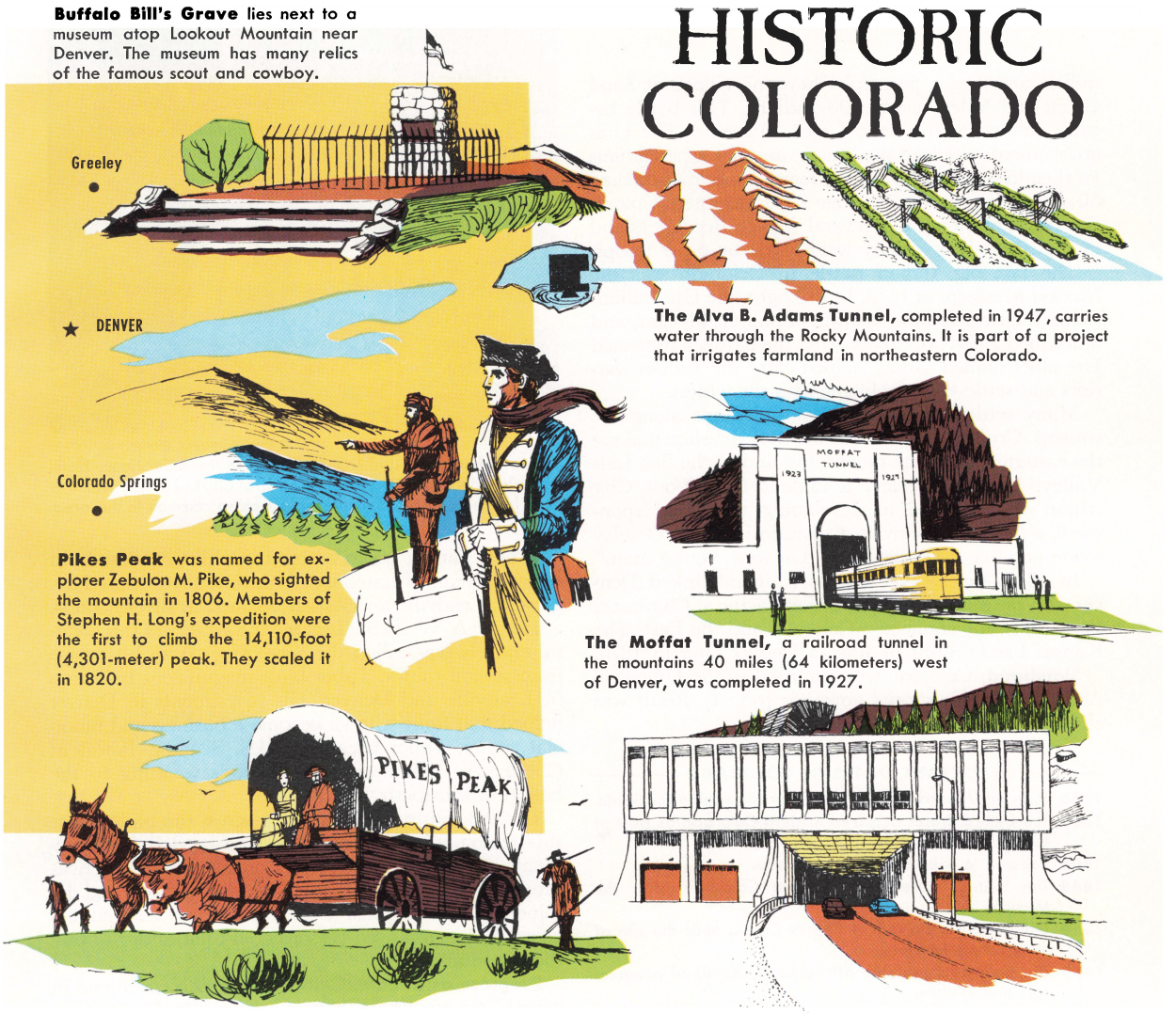
"West Point of the Air," the U.S. Air Force Academy, moved to its new home near Colorado Springs in 1958.

COLORADO / *History*

Indian Days. Indians roamed the plains of present-day Colorado before white men arrived. Early explorers found the Arapaho, Cheyenne, Comanche, Kiowa, and Pawnee tribes on the plains. The Utes lived in the mountain valleys.

Exploration and Settlement. Spanish explorers who came in the 1500's were the first white men to visit the Colorado region. The Spaniards failed to find gold, and left without attempting to settle the area. In 1682, the explorer Robert Cavelier, Sieur de la Salle, claimed for France an area that included what is now eastern Colorado. In 1706, Juan de Ulibarri, a Spanish official, claimed the region for Spain.

In 1803, the United States bought present-day eastern and central Colorado as part of the Louisiana Purchase. During the next 20 years, Americans explored



Buffalo Bill's Grave lies next to a museum atop Lookout Mountain near Denver. The museum has many relics of the famous scout and cowboy.

The Alva B. Adams Tunnel, completed in 1947, carries water through the Rocky Mountains. It is part of a project that irrigates farmland in northeastern Colorado.

Pikes Peak was named for explorer Zebulon M. Pike, who sighted the mountain in 1806. Members of Stephen H. Long's expedition were the first to climb the 14,110-foot (4,301-meter) peak. They scaled it in 1820.

The Moffat Tunnel, a railroad tunnel in the mountains 40 miles (64 kilometers) west of Denver, was completed in 1927.

"Pikes Peak or Bust" was the cry of the gold seekers. A rush of miners followed rich strikes in Colorado in 1859. In 1891, Robert Womack made the greatest strike, at Cripple Creek.

The Eisenhower Memorial Tunnel, west of Denver, is the highest tunnel for motor vehicles in the world. It extends about 1.7 miles (2.7 kilometers) at an altitude of about 11,000 feet (3,400 meters) above sea level.

much of the region. Zebulon M. Pike, an army officer, entered the Colorado area in 1806. Pike's record of the trip describes the mighty mountain that was named for him—Pikes Peak. Another officer, Major Stephen H. Long, led an exploring party in 1820. The first permanent American settlement was Bent's Fort, built in 1833 by the Bent and St. Vrain Fur Company. The fort, near the site of present-day La Junta, was used as a base by Kit Carson and other famous frontiersmen.

Mexico won control of western Colorado from Spain in 1821. The United States took control during the Mexican War (1846-1848). The United States kept the land under the terms of the treaty that ended the war.

The Gold Rush. Colorado had few settlers until the late 1850's. Then, in 1858, prospectors found gold along Cherry Creek, near the site of present-day Denver. Gold hunters rushed into the area. "Pikes Peak or Bust" became the slogan of the prospectors as they traveled the long, hard trail to the Colorado gold fields. The rush reached its height by the end of 1859, when about 100,000 persons had reached the area.

Governing the booming area became a major problem. The Indians claimed that the land had been given to them by various treaties. The miners ignored the Indian claims and set up what they called the Jefferson Territory. Congress refused to recognize the Jefferson Territory, and created the Colorado Territory in 1861. William Gilpin was appointed as the first territorial governor. See JEFFERSON TERRITORY.

Territorial Days. Indians and whites fought many small clashes and three important battles during the 1860's and 1870's. In 1864, troops of the Colorado

militia attacked a peaceful Cheyenne village at Sand Creek and killed nearly 300 Indians. This battle became known as the Sand Creek Massacre. The U.S. government criticized the attack, and paid the Indians for their losses. In 1868, a large force of Indians attacked 50 army scouts on the Arikaree River in eastern Colorado. The scouts fought for several days on Beecher Island in the river. They finally were saved by other troops.

The last big Indian battle in Colorado was the Meeker Massacre in 1879. In this fight, the Ute Indians killed their reservation agent, Nathan C. Meeker, and ambushed a body of troops. After the battle, a respected Ute chief named Ouray helped calm the Indian warriors and settle their problems with the whites.

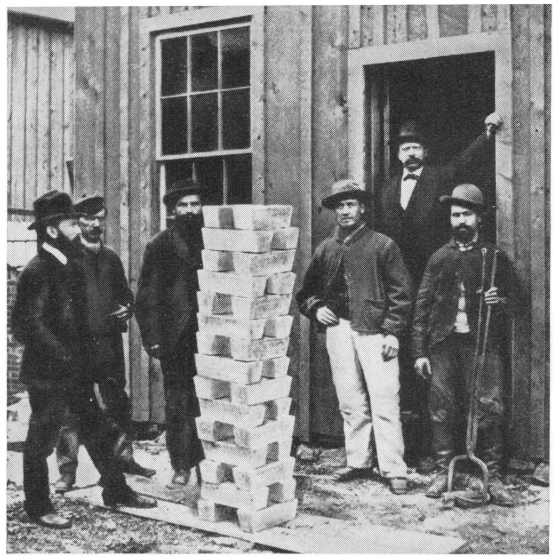
Many settlers started ranches and farms along the streams. Crude irrigation systems were developed along the eastern edge of the mountains, and in the San Luis Valley. Horace Greeley, a famous New York City editor who believed in developing the West, sponsored a farming colony in Colorado in 1870. Greeley made popular the expression, "Go west, young man."

In 1870, the Denver Pacific Railroad linked Denver with the main line of the Union Pacific at Cheyenne, Wyo. This line connected Colorado and the East. The Kansas Pacific built its line to Denver later in 1870.

Statehood. Colorado was admitted to the Union on Aug. 1, 1876. Territorial governor John L. Routt was elected as the first state governor.

IMPORTANT DATES IN COLORADO

1706 Juan de Ulibarri claimed the Colorado region for Spain.
1803 The United States acquired eastern Colorado as part of the Louisiana Purchase.
1806 Zebulon M. Pike explored Colorado.
1848 The United States took western Colorado after the Mexican War.
1858 Gold was discovered at Cherry Creek, near the site of what is now Denver.
1859 The Colorado gold rush attracted thousands of prospectors and settlers.
1861 Congress created the Colorado Territory.
1870 The Denver Pacific Railroad was completed to Denver.
1876 Colorado became the 38th state on August 1.
1879 The Meeker Massacre marked the end of serious Indian fighting.
1899 The state's first beet-sugar factory began operating.
1906 The U.S. Mint in Denver issued its first coins. Congress established Mesa Verde National Park.
1915 Rocky Mountain National Park was established.
1927 The Moffat Tunnel, a railroad tunnel through the mountains, was completed.
1956 The Colorado River water storage project was approved by Congress.
1958 The U.S. Air Force Academy's permanent campus opened near Colorado Springs.
1959 The Colorado-Big Thompson irrigation system was completed.
1962 Ground was broken for the three-dam Curecanti water storage project.
1966 North American Air Defense Command completed its underground operations center in Cheyenne Mountain.
1974 Oil companies invested millions of dollars to lease federally owned oil-shale land in Colorado.



Denver Public Library Western Collection

Silver Bricks were laid from the street to the Teller House Hotel when President U. S. Grant visited Central City in 1873. Silver was used instead of gold because gold was so common in the area.

A new mining boom brought wealth to Colorado in the early years of statehood. This time silver caused the growth. Leadville and Aspen boomed as silver centers.

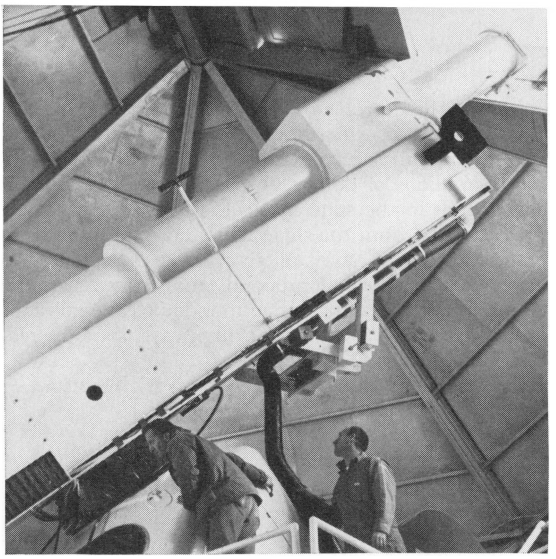
Horace A. W. Tabor became the symbol of this colorful era. He was called the *Silver King*. With his profits from several mines, Tabor built magnificent buildings in Leadville and Denver. His investments in Denver helped that frontier town become a business and financial center. Tabor became a U.S. Senator. President Chester A. Arthur attended Tabor's wedding to the beautiful Elizabeth "Baby" Doe.

In 1893, business slumped all across the nation. For this reason, the U.S. government canceled its agreements to buy large amounts of silver. Silver prices dropped. In Colorado, many silver mines closed and the miners lost their jobs. Other businesses suffered because the unemployed persons could not afford to buy their products.

Progress as a State. Colorado's growth continued in spite of the state's troubles. A major gold discovery at Cripple Creek softened the blow of the silver crash. Farmers began to experiment with different crops, and expanded their irrigation systems. Sugar beets and potatoes became valuable Colorado crops. The state's first sugar refinery opened in Grand Junction in 1899. In 1902, construction started on a railroad over the Continental Divide. In 1906, the U.S. Mint in Denver produced its first coins.

By 1910, Colorado had almost 800,000 persons. Agriculture had replaced mining as the state's most important industry. Colorado had more irrigated land than any other state. The food processing industry grew as canneries and more sugar refineries were built in the state.

The 1910's and 1920's. The development of automobiles in the early 1900's caused rapid growth in two Colorado industries—oil and tourism. The family car made vacation travel easier, and Colorado's splendid scenery attracted thousands of tourists. Cars also increased the demand for petroleum products. Colorado's first oil wells were drilled in the Arkansas Valley during territorial days, but production was small. Later, new



National Center for Atmospheric Research

Colorado Scientists study the earth's atmosphere at an observation station near Climax. Major scientific centers in Colorado carry on space age research.

oil fields were discovered. By 1920, oil had become Colorado's most important mineral product.

The state government kept pace with the advances in industry. For example, a plan of workmen's compensation was passed in 1915. In 1927, the famous Moffat railroad tunnel was completed with state funds.

The Depression. Colorado's economy suffered during the Great Depression of the 1930's. Farm prices dropped sharply, and stayed low. A long period of dry weather began on the eastern plains. Wind whipped the dry, powdery soil into huge dust clouds, and dust storms darkened the sky. The state and federal governments began programs to restore the wind-damaged land, and to help the unemployed. In 1935, the Colorado legislature voted a 2 per cent sales tax to raise money for old-age pensions. Highway construction and other programs helped put men back to work.

The Mid-1900's. Colorado's economy boomed during World War II (1939-1945). The war brought a great demand for Colorado metals and oil, and the government established several air bases in the state. The army opened Fort Carson near Colorado Springs and a huge ordnance plant at Pueblo. Military payrolls in Colorado jumped from $3 million in 1940 to $152 million in 1945.

The state's population increased after the war, and Colorado has ranked among the nation's fastest growing areas since 1945. Many suburbs developed around major cities in central Colorado.

With the population growth, Colorado's need for flood control, irrigation, and water storage became severe. Central Colorado and the eastern plains have often suffered either long droughts or sudden floods. Cherry Creek Dam near Denver was completed in 1949. In 1947, the Alva B. Adams Tunnel was completed. This tunnel carries water through the Rocky Mountains from western Colorado to the area east of the mountains. It is part of the huge Colorado-Big Thompson Project, which was completed in 1959. The Colorado-Big Thompson is a series of dams, pumping stations, reservoirs, and tunnels that irrigates about 720,000 acres (291,000 hectares) of farmland. It also includes six hydroelectric power plants.

More federal offices and military installations were established in Colorado during the 1950's. The National Bureau of Standards laboratory moved from Washington, D.C., to Boulder in 1954. The Air Force set up its worldwide financial center in Denver. The United States Air Force Academy opened its Colorado Springs campus in 1958. The North American Air Defense Command (NORAD) combat operations center made its headquarters near Colorado Springs. The center was completed in 1966. It is 1,200 feet (366 meters) underground in Cheyenne Mountain.

By 1954, manufacturing had replaced agriculture as the state's leading industry. The larger manufacturing plants produced atomic warheads, missiles, and other military items. The manufacture of electronic parts and the mining and milling of uranium became important industries in western Colorado.

Work on the Colorado River Storage Project began in 1956. A major part of this project includes the Curecanti storage system of three dams, begun in 1962. By 1964, 24 other parts of the project were under construction or in the planning stage.

The Frying Pan-Arkansas River Project, started in the early 1960's, was scheduled for completion in the late 1970's. It was designed to bring water to the eastern plains of Colorado. In 1965, floods on the South Platte River threatened Denver. Construction of two

THE GOVERNORS OF COLORADO

	Party	Term
1. John L. Routt	Republican	1876-1879
2. Frederick W. Pitkin	Republican	1879-1883
3. James B. Grant	Democratic	1883-1885
4. Benjamin H. Eaton	Republican	1885-1887
5. Alva Adams	Democratic	1887-1889
6. Job A. Cooper	Republican	1889-1891
7. John L. Routt	Republican	1891-1893
8. Davis H. Waite	Populist	1893-1895
9. Albert W. McIntire	Republican	1895-1897
10. Alva Adams	Democratic	1897-1899
11. Charles S. Thomas	Democratic	1899-1901
12. James B. Orman	Democratic	1901-1903
13. James H. Peabody	Republican	1903-1905
14. Alva Adams	Democratic	1905
15. James H. Peabody	Republican	1905
16. Jesse F. McDonald	Republican	1905-1907
17. Henry A. Buchtel	Republican	1907-1909
18. John F. Shafroth	Democratic	1909-1913
19. Elias M. Ammons	Democratic	1913-1915
20. George A. Carlson	Republican	1915-1917
21. Julius C. Gunter	Democratic	1917-1919
22. Oliver H. Shoup	Republican	1919-1923
23. William E. Sweet	Democratic	1923-1925
24. Clarence J. Morley	Republican	1925-1927
25. William H. Adams	Democratic	1927-1933
26. Edwin C. Johnson	Democratic	1933-1937
27. Ray H. Talbot	Democratic	1937
28. Teller Ammons	Democratic	1937-1939
29. Ralph L. Carr	Republican	1939-1943
30. John C. Vivian	Republican	1943-1947
31. W. Lee Knous	Democratic	1947-1949
32. Walter W. Johnson	Democratic	1949-1951
33. Dan Thornton	Republican	1951-1955
34. Edwin C. Johnson	Democratic	1955-1957
35. Stephen L. R. McNichols	Democratic	1957-1963
36. John A. Love	Republican	1963-1973
37. John D. Vanderhoof	Republican	1973-1975
38. Richard D. Lamm	Democratic	1975-

more dams was begun in 1967 to control flooding.

Colorado Today. The Colorado General Assembly voted in 1969 to help in the 1970's with the problems of rising costs of local government. It voted to pay all costs of operating lower courts throughout the state and to pay a greater part of the costs of local public education than previously. It established funds for aid and loans to poor students. Metropolitan planning groups, set up by the Assembly, are working to solve problems of cities and suburbs. These problems include air and water pollution and mass transportation.

Oil companies, encouraged by rising oil prices, invested millions of dollars to lease federally owned oil shale lands in the state in 1974. But the high cost of producing oil from the shale rock and opposition from environmentalists have stalled rapid development. Voters have also rejected proposals that may harm the environment, including underground nuclear explosions and construction of mountain highways, some recreational facilities, and storage dams.

TIM K. KELLEY, PASQUALE L. MARRANZINO, and MICHAEL MCGIFFERT

COLORADO / *Study Aids*

Related Articles in WORLD BOOK include:

BIOGRAPHIES

Bonfils, Frederick G.
Carpenter, M. Scott
Dempsey, Jack
Greeley, Horace
Guggenheim (family)
Pike, Zebulon M.
Roosa, Stuart A.
Sabin, Florence R.
Teller, Henry M.
White, Byron R.
Whiteman, Paul

CITIES

Aspen
Colorado Springs
Denver
Grand Junction
Greeley
Leadville
Pueblo

HISTORY

Arapaho Indians
Cheyenne Indians
Cliff Dwellers
Comanche Indians
Indian Wars
Jefferson Territory
Ute Indians
Westward Movement

PHYSICAL FEATURES

Arkansas River
Cherry Creek Dam
Colorado River
Dust Bowl
Garden of the Gods
John Martin Dam
Moffat Tunnel
Mount Evans
Mount of the Holy Cross
Pikes Peak
Rio Grande
Rocky Mountains
Royal Gorge
Sangre de Cristo Mountains
Shadow Mountain Dam

PRODUCTS

For Colorado's rank among the states in production, see the following articles:

Bean
Lead
Lettuce
Sheep
Sugar
Uranium
Wool

OTHER RELATED ARTICLES

Easter (picture)
Ent Air Force Base
Rocky Mountain States
United States Air Force Academy
Western Frontier Life

Outline

I. Government
- A. Constitution
- B. Executive
- C. Legislature
- D. Courts
- E. Local Government
- F. Taxation
- G. Politics

II. People

III. Education
- A. Schools
- B. Libraries
- C. Museums

IV. A Visitor's Guide
- A. Places to Visit
- B. Annual Events

V. The Land
- A. Land Regions
- B. Rivers and Lakes

VI. Climate

VII. Economy
- A. Natural Resources
- B. Manufacturing
- C. Agriculture
- D. Mining
- E. Electric Power
- F. Transportation
- G. Communication

VIII. History

Questions

How are eastern Colorado's water problems being solved?

What are two main mineral products of Colorado?

Where is the highest road in the United States?

Where are most of Colorado's cities?

Why is Colorado called the Centennial State?

Why was H. A. W. Tabor important to Denver?

How and when did the slogan "Pikes Peak or Bust" originate?

What is Colorado's most important agricultural activity?

What military defense center is located underground in Colorado? Where is it?

What mountains are called the *Roof of North America?* Why?

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COLORADO, UNIVERSITY OF, is a state-supported coeducational university in Boulder, with centers in Colorado Springs and Denver. It offers courses in the arts and sciences, business, education, environmental design, journalism, law, music, and pharmacy.

The Boulder campus includes the Laboratory for Atmospheric and Space Physics, Sommers-Bausch Observatory, Nuclear Physics Laboratory, Joint Institute for Laboratory Astrophysics, and institutes in behavioral science, behavioral genetics, and arctic and alpine research. The Medical Center in Denver has schools of medicine, dentistry, and nursing, and research centers.

The university's summer Creative Arts Festival in Boulder includes dance, drama, fine arts events, music, and a Shakespeare Festival. A Conference on World Affairs is held every spring. The university was chartered in 1861. For enrollment, see UNIVERSITIES AND COLLEGES (table). FREDERICK P. THIEME

COLORADO BEETLE. See POTATO BUG.

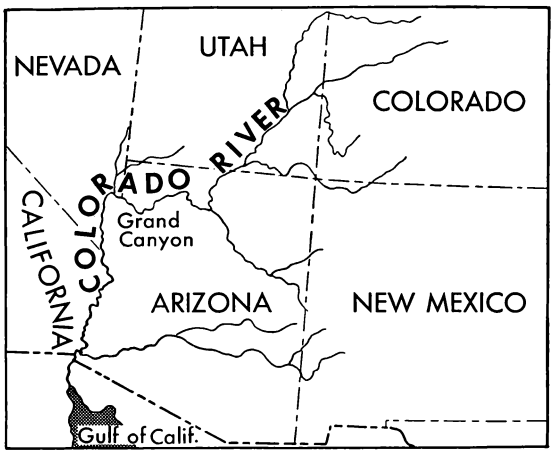
COLORADO-BIG THOMPSON PROJECT. See COLORADO (The mid-1900's).

COLORADO COLLEGE is a coeducational liberal arts school at Colorado Springs, Colo. Bachelor's and master's degrees are offered in most departments. A fine arts course is given in connection with the Colorado Springs Fine Arts Center. The college was founded in 1874. For enrollment, see UNIVERSITIES AND COLLEGES (table).

COLORADO DESERT occupies about 2,000 square miles (5,200 square kilometers) of southeastern California west of the Colorado River. The Santa Rosa Mountains and Coast Ranges separate it from the Pacific Ocean. The Mojave Desert lies to the north and west of the Colorado Desert. For the location of the Colorado Desert, see CALIFORNIA (color map). Parts of the Colorado Desert lie 245 feet (75 meters) below sea level. The desert includes the Salton Sea in southern California, formed in 1905 when irrigation engineers lost control of the Colorado River (see SALTON SEA). Hoover Dam and other Colorado River dams furnish water to the Colorado Desert's Imperial and Coachella valleys (see IMPERIAL VALLEY). GEORGE SHAFTEL

COLORADO NATIONAL MONUMENT, in western Colorado, includes many strange rock formations, such as Devil's Kitchen, Window Rock, and Monolith Parade. It also has prehistoric remains and a deer, buffalo, and elk preserve. Colorado National Monument was established in 1911. It covers about 17,500 acres (7,082 hectares). C. LANGDON WHITE

COLORADO RIVER, one of the major rivers in the United States, is 1,450 miles (2,334 kilometers) long. It flows across 1,360 miles (2,189 kilometers) of the United States and 90 miles (145 kilometers) of Mexico. It rises in the Rocky Mountains of Colorado, and flows southwestward into Utah. The Colorado is joined by the Green River in eastern Utah, then continues southwestward into Arizona. After merging with the Little Colorado River in northern Arizona, the river swings west through the Grand Canyon. The Virgin River of Nevada joins its course beyond the Grand Canyon. The Colorado then turns south, and flows across the Mexican border to the Gulf of California. Arizona's Williams and Gila rivers merge with the river north of the Mexican border. The Colorado River drains an area of about 250,000 square miles (647,000 square kilometers).



Location Map of the Colorado River

The Grand Canyon of the Colorado River presents an outstanding example of the effects of wind, water, and weather on the earth's surface. For millions of years, the river worked its way into layer after layer of rock, gradually deepening and broadening its channel. Sand, pebbles, and boulders carried by the river produced a constant grinding action. The action of wind and temperature and the gradual elevation of the Colorado plateau added to the effect of the grinding. The Grand Canyon now consists of a great gash in the earth more than 1 mile (1.6 kilometers) deep and between 14 and 18 miles (23 and 29 kilometers) wide in some places.

Many rapids and waterfalls lie along the course of the Colorado. The waters carry tons of silt and sand. Until Hoover Dam was built, the river deposited these materials in its lower river valley, forming a rich delta country. The Hoover Dam, completed in 1936, helps check floods and erosion, and provides a dependable supply of water and electric power. Davis, Parker, and Imperial dams, which lie downstream from Hoover Dam, also help regulate the flow of water. In 1956, Congress passed a bill providing for the construction of four major power dams and a number of water-supply units on the Colorado and its branches. Construction began in 1957 on the Glen Canyon Dam, one of the four major dams. The Navajo Dam was completed in 1963, and the Flaming Gorge and Glen Canyon dams were completed in 1964. The Colorado-Big Thompson Project diverts water from the Colorado and stores it. The water is used to irrigate 720,000 acres (291,000 hectares) of land in north-central Colorado.

Plans were announced in 1963 to develop recreation areas and wildlife preserves along both banks of the lower Colorado River. The plans affect about 400,000 acres (160,000 hectares) of land between Hoover Dam and the Mexican border along about 265 miles (426 kilometers) of the river. ALICE B. GOOD

See also AQUEDUCT (Present-Day); GRAND CANYON NATIONAL PARK; HOOVER DAM; POWELL, JOHN W.

COLORADO RIVER forms a major drainage system of central Texas. It rises at the edge of the Staked Plains and flows southeast 840 miles (1,350 kilometers) into the Gulf of Mexico at Matagorda Bay. The river drains an area as large as Tennessee. Six artificial lakes furnish water for power and irrigation. They are Bu-

The Colosseum, or Flavian Amphitheater, in Rome, is one of the most famous ruins in the world. The ruins rise to a height of four stories on one side. Thousands of tourists visit the Colosseum every year to photograph it as one of the few remaining evidences of the glory of ancient Rome.

chanan, Inks, Lyndon B. Johnson, Marble Falls, Travis, and Austin. Austin, the capital of Texas, is on the river. H. Bailey Carroll

COLORADO SCHOOL OF MINES. See Universities and Colleges (table).

COLORADO SPRINGS, Colo. (pop. 135,060; met. area 239,288), is a tourist and recreation center famed for its rugged Rocky Mountain setting. It lies 5,980 feet (1,823 meters) above sea level, east of Pikes Peak (see Colorado [political map]). Colorado Springs has a healthful year-round climate, with an average of over 300 days of sunshine. It is the second largest city in the state.

Colorado College and a campus of the University of Colorado are in Colorado Springs. Points of interest include the Garden of the Gods, Pikes Peak, and the Will Rogers Shrine of the Sun Memorial. The United States Air Force Academy is north of the city. Other installations include Ent Air Force Base, Cheyenne Mountain Combat Operations Center of the North American Air Defense Command (NORAD), and Fort Carson, home of the U.S. Army's 5th Infantry Division.

Colorado Springs has about 200 manufacturing firms. These firms make such products as tools, plastics, furniture, and airplane equipment.

Colorado Springs was founded in 1871. It has a council-manager form of government, and is the seat of El Paso County. Harold H. Dunham

COLORADO STATE UNIVERSITY is a coeducational land-grant school in Fort Collins, Colo. It has colleges of agricultural sciences, business, engineering, forestry and natural resources, home economics, humanities and social sciences, natural sciences, and veterinary medicine and biomedical sciences. Courses lead to bachelor's, master's, and doctor's degrees. It began as the Agricultural College of Colorado in 1870, and was known as the Colorado Agricultural and Mechanical College from 1951 to 1957. For enrollment, see Universities and Colleges (table). A. R. Chamberlain

COLORED PEOPLE. See Negro; Races of Man.

COLORED PEOPLE, NATIONAL ASSOCIATION FOR THE ADVANCEMENT OF. See National Association for the Advancement of Colored People.

COLOSSEUM, *kahl uh SEE uhm*, or Flavian Amphitheater, is perhaps the finest surviving example of ancient Roman architectural engineering. It stands near the center of present-day Rome. The Colosseum is shaped like a present-day football stadium. It could seat about 45,000 spectators. Such spectacles as fights between gladiators and between men and wild animals were held there.

The four-story Colosseum is 161 feet (49 meters) high, about 600 feet (180 meters) long, and 500 feet (150 meters) wide. Awnings could be hung from the walls to protect spectators from the sun. Half columns decorated the *façade* (outer part) of the Colosseum, and archways separated the columns. The fourth-story walls have rectangular windows and *pilasters* (flat columns attached to the walls). The oval-shaped *arena* (sand-covered area) on the floor is 282 feet (86 meters) long, and 207 feet (63 meters) across at its widest point.

Originally, the arena could be flooded for water spectacles. Later, however, cages for men and animals were installed beneath the arena. A wall separated the spectators from the arena. The seats for spectators rested on sloping concrete supports as in many stadiums today.

Construction of the Colosseum started during the reign of Emperor Vespasian, who ruled from A.D. 69 to 79. Construction was completed in A.D. 80, during the reign of Titus. William P. Donovan

See also Roman Empire (picture: At the Colosseum); Rome (picture: Ancient Rome).

COLOSSIANS, EPISTLE TO THE, the 12th book of the New Testament, was written by the Apostle Paul about A.D. 62. The *epistle* (letter) warned against teachings that tried to reduce the importance of Christ. It was addressed to Christians in Colossae (now central Turkey). Paul was a prisoner, probably in Rome, at the time. See also Paul, Saint. William Wilson Sloan

COLOSSUS OF RHODES. See SEVEN WONDERS OF THE WORLD.

COLOSSUS OF THE NORTH. See LATIN AMERICA (Relations with the United States).

COLOUR. See COLOR.

COLT. See HORSE (Horse Terms).

COLT, SAMUEL (1814-1862), developed the first successful repeating pistol. The pistol, patented in England in 1835, had a cylinder of several chambers that could be discharged in succession by the same locking and firing mechanism (see REVOLVER). Colt established a factory at Hartford, Conn., where he also produced arms used during the Mexican War and the Civil War. After Colt's death, his company made the famous six-shooters that were used throughout the West. Colt was born in Hartford. CHARLES EDWARD CHAPEL

Wood engraving (1856) by H. Wright Smith; The New York Public Library, New York City

Samuel Colt

See also WESTERN FRONTIER LIFE (color picture).

COLTER, JOHN (1770?-1813), an American trapper, discovered and explored the Yellowstone region. He was born near Staunton, Va., and spent his early days on a farm. In October, 1803, he enlisted for the Lewis and Clark expedition near Maysville, Ky. He stayed with the expedition until 1806.

Colter left the expedition in 1806 to become a mountain man. He planned to join two companions and remain in the upper Missouri River area for at least two years in pursuit of his fortune. For a considerable period, Colter was lost to civilization. He probably spent his time in the West, wandering along the Missouri River and through the Rocky Mountains. The scene of his greatest activity was along the Yellowstone River. He associated closely with many Indian tribes.

In 1807, Colter was in the Yellowstone basin on a fur-hunting expedition. During this period, he made his famous exploring journey into the wild countryside and discovered the great thermal springs area that is now Yellowstone National Park. He also discovered several passes through the Rocky Mountains.

Colter's exploits in the mountains have been a basic source of information about American frontier expansion in that region. He returned to St. Louis in 1810 and retired as a mountain man. THOMAS D. CLARK

COLTRANE, JOHN WILLIAM (1926-1967), was a famous jazz saxophonist and composer. His sometimes violent style made him one of the most controversial and widely imitated jazz musicians of the 1960's. Coltrane was also one of the first jazz performers to reflect the influence of the music of India.

Coltrane was born in Hamlet, N.C. He played in the bands of Dizzy Gillespie and Johnny Hodges during the early 1950's. He achieved greater recognition as a frequent soloist with the Miles Davis quintet between 1955 and 1960. Coltrane formed his own quartet in 1960, and scored a popular success with a recording of the song "My Favorite Things." Previously a tenor saxophonist, he played the soprano saxophone on this record. Coltrane did much to popularize the soprano saxophone among jazz musicians. LEONARD FEATHER

COLT'S-TAIL. See FLEABANE.

COLTSFOOT is a wild plant of Europe and Asia. It also now grows in northeastern United States and in Canada. The coltsfoot has light-yellow flowers that look like dandelion blossoms. The flowers bloom in March or April, and are borne on stems that have no leaves. The leaves appear after the flowers have died. They are large and broad, and downy on the underside. The leaves are round at first, but later become shaped like a heart or a colt's foot. The *false coltsfoot* and the *beetleweed* are not true coltsfoot plants.

Bureau of Plant Industry, USDA

Coltsfoot

Scientific Classification. The coltsfoot is in the composite family, *Compositae*. It forms the genus *Tussilago*. HAROLD NORMAN MOLDENKE

COLUM, PADRAIC (1881-1972), was an original member of the group of Irish writers that made Dublin's Abbey Theatre famous. He wrote three important plays for the Abbey—*Broken Soil* (1903, revised as *The Fiddler's House*), *The Land* (1905), and *Thomas Muskerry* (1910). Each is a realistic study of peasant or provincial life and each was intended as part of a connected "comedy of Irish life through all the social stages."

Colum was born in County Longford, and moved to the United States in 1914. He then began writing young people's books based on myth and folklore. These books include *The Adventures of Odysseus* (1918) and *The Children of Odin* (1920).

Colum's verse—from *Wild Earth* (1907) to *Collected Poems* (1953)—is a subtle rendering of simple speech and song patterns. Colum's verse is clear in style and nostalgic in feeling. MARTIN MEISEL

COLUMBA, SAINT. See MISSIONS AND MISSIONARIES.

COLUMBIA. Long before the Revolutionary War, many people felt that America should have been named Columbia after the explorer Christopher Columbus. During the war, poets in the 13 colonies used the name Columbia to describe the new nation that was to become the United States. The word was first used by Phillis Wheatley, a Negro

Detail of *Proprieta Artistica*, a chromolithograph after a painting (1893) by Rodolfo Morgari; Chicago Historical Society

Columbia

slave poetess in Massachusetts, in a poem honoring George Washington. Philip Freneau popularized the term in several poems during and after the war. It appeared first in law in 1784 when King's College in New York City became Columbia College. Towns, counties, and institutions throughout the United States have since adopted the name.

Many artists have symbolically pictured Columbia as a tall, stately woman dressed in flowing garments and holding an American flag. A blue, flaglike drape with white stars is usually part of her costume. During the 1800's, Columbia appeared on the prows of ships, in patriotic paintings, and in pageants representing the spirit of the American Revolution. The bronze *Statue of Freedom*, on top of the United States Capitol in Washington, D.C., is often incorrectly called a statue of Columbia. MERRILL JENSEN

COLUMBIA, Mo. (pop. 58,812; met. area 80,935), is the home of the main campus of the University of Missouri. It ranks as one of the medical centers of the Middle West, with the university's schools of medicine and nursing, the university hospitals, the Ellis Fischel State Cancer Hospital, and the Boone County Hospital. Stephens College and Columbia College are also in Columbia. The state historical society maintains its library in the city. Columbia has a council-manager form of government. The city lies about 130 miles (209 kilometers) west of St. Louis (see MISSOURI [political map]). NOEL P. GIST

COLUMBIA, S.C. (pop. 113,542; met. area 322,880), is the state's capital and largest city. It is on the east side of the Congaree River, just below the junction of the Broad and Saluda rivers (see SOUTH CAROLINA [political map]).

State, federal, and county offices in Columbia employ about 19,000 persons. The city serves as the distributing center for many industries of statewide importance. Over 250 industrial plants are in the area.

Greater Columbia Chamber of Commerce

The Domed State House at Columbia, S.C., *center,* **is a gray granite building of Italian Renaissance design.**

Chief manufactures include chemicals, concrete products, electronics equipment, lumber, metal products, processed foods, and textiles. The printing and publishing industry is also important. The State Farmers Market in Columbia has made the city a leading farm-marketing center of the Southeast.

South Carolina's Capitol, called *State House,* is the leading point of historic interest in Columbia. Architects modeled the building after the U.S. Capitol in Washington, D.C. Construction of the present building began in 1855. The army of Gen. William T. Sherman damaged the partially completed building in 1865. But the state government restored the Capitol for use in 1869, and the structure was finished in its present form in 1907.

Columbia has several churches of historic interest. The First Baptist Church, built in 1859, served as the meeting place of the Secession Convention in 1860. The parents of Woodrow Wilson lie in the graveyard of the First Presbyterian Church. The Washington Street Methodist Church stands on the supposed site of the first Christian house of worship built in Columbia.

Other points of interest in Columbia include the boyhood home of Woodrow Wilson, the executive mansion, and the Town Theatre, one of the oldest little theaters in the country. Institutions of higher learning in the city include Benedict College, Columbia College, and the University of South Carolina.

The South Carolina legislature selected Columbia's site in 1786. The legislature bought 4 square miles (10 square kilometers) of land and reserved a space in the center of the square-shaped site for the Capitol. It also planned two streets 150 feet (46 meters) wide to divide the square into four sections, with streets 100 feet (30 meters) wide at right angles. The legislature governed the city until 1805. Annexations increased the area of the site to about $18\frac{1}{2}$ square miles (48 square kilometers). Columbia has a council-manager government. It is the seat of Richland County. JULIAN J. PETTY

See also SOUTH CAROLINA (color picture: State Capitol).

COLUMBIA, MOUNT. See ALBERTA (Land Regions).

COLUMBIA BROADCASTING SYSTEM. See CBS INC.

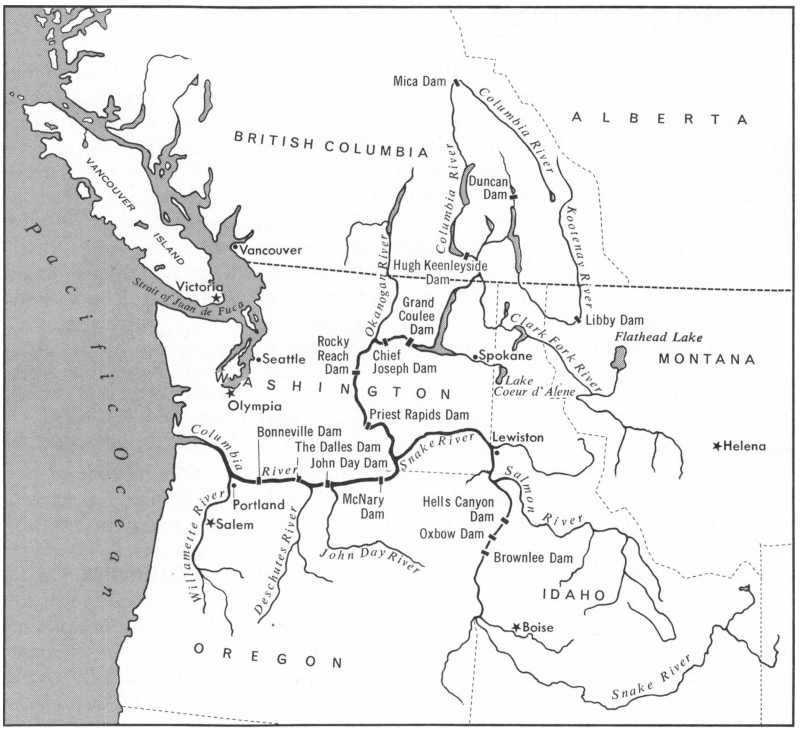
COLUMBIA COLLEGE. See UNIVERSITIES AND COLLEGES (table).

COLUMBIA ICE FIELD. See ALBERTA (Places to Visit).

COLUMBIA PLATEAU. See PACIFIC COAST STATES (Land Regions); IDAHO (Land Regions).

COLUMBIA RIVER is an important waterway of the Pacific Northwest region of the United States, and of southwestern Canada. It ranks as one of the greatest salmon streams in the world. The river is also famous for the hydro-electric plants, irrigation projects, and scenery along its course. The Columbia River is 1,214 miles (1,954 kilometers) long, and drains an area of about 259,000 square miles (670,800 square kilometers). About 220,000 square miles (570,000 square kilometers) of this area lie in the United States.

Course. The Columbia River rises on the western slopes of the Rocky Mountains in the Canadian province of British Columbia. From its source in Lake Columbia, it flows northwestward for 180 miles (290 kilometers) through a wild, forested region. Waters from the thaws of large snow and ice fields feed the Columbia in this area. Then it makes a sharp curve to the south into



The Historic Columbia River drains an area of 259,000 square miles (670,800 square kilometers) in the highly productive Pacific Northwest region.

Washington. The Kootenay and Pend Oreille rivers join the Columbia north of the international border. In Washington, the Columbia sweeps westward and southward along the Big Bend. Just below the point where the Snake River joins the Columbia, it turns westward to form the boundary between Washington and Oregon to the Pacific Ocean. The river passes through the Cascade Mountains by way of the deep Columbia Gorge. See OREGON (Places to Visit [Columbia River Gorge]).

Ports. The mouth of the Columbia River forms the main Pacific Coast harbor between San Francisco and the Strait of Juan de Fuca. Astoria, Ore., is an important fishing port at the entrance to the river. The major river port is Portland, Ore., lying on the Willamette River near where it joins the Columbia. The leading river ports in Washington are Vancouver and Longview. Canal and lock systems permit small vessels to travel past power dams on the lower part of the Columbia River and sail up the Snake River as far as Lewiston, Ida.

Hydroelectric Development. The Columbia River Basin has more than one-third of the potential water power of the United States, and is one of the world's great water-power regions. Federal and private agencies have built more than 25 power dams on the Columbia and its tributaries. Among the largest of these are the Grand Coulee Dam and the John Day Dam. Most of the power dams in the Columbia River Basin provide water for recreation and irrigation. They also may be used for flood control.

In 1964, the United States and Canada reached final agreement on a multimillion dollar joint power and flood-control treaty to end flood damage and provide cheaper sources of power for both countries. Canada built the Duncan, Hugh Keenleyside, and Mica dams in British Columbia. The United States built the Libby Dam in Montana. HOWARD J. CRITCHFIELD

See also BONNEVILLE DAM; GRAND COULEE DAM; GRAY, ROBERT.

COLUMBIA RIVER HIGHWAY is one of the most famous automobile routes in the Pacific Northwest. It extends from Pendleton, in northeastern Oregon, to Astoria, Ore., on the Pacific Coast. It follows part of the old Oregon Trail. It is 322 miles (518 kilometers) long and forms the western end of U.S. Highway No. 30. Scenic spots include the Hood River and Bonneville Dam. Work on the road began in 1913, and was completed in 1915. A project to modernize the highway was finished in 1956. MATTHEW C. SIELSKI

COLUMBIA UNION COLLEGE. See UNIVERSITIES AND COLLEGES (table).

COLUMBIA UNIVERSITY is a privately endowed university in New York City. Its campus is at Morningside Heights, in upper Manhattan. Columbia ranks among America's leading universities in liberal arts and professional studies.

Its Divisions include Columbia College; the schools of architecture, arts, engineering and applied science, international affairs, law, and social work; and graduate schools of arts and sciences, business, journalism, and library service. The university's faculty of medicine includes the college of physicians and surgeons, and schools of public health, nursing, and dental and oral surgery. The university also has a School of General Studies that offers special adult education programs. Columbia College is the university's undergraduate school of liberal arts for men. About 2,700 men are en-

rolled in this college. All other divisions of the university admit both men and women.

Affiliated Institutions. Three colleges in New York City are affiliated with Columbia University. Barnard College was established by the trustees of Columbia University as an undergraduate school for women. It awarded its first bachelor's degrees in 1893. Barnard students now attend classes at Columbia and receive degrees from Columbia University. Barnard is named for Frederick A. P. Barnard, the tenth president of Columbia University. Teachers College is a graduate school of education. It offers programs leading to master's and doctor's degrees. Teachers College was established in 1887 and became part of Columbia University in 1898. It granted its first degrees in 1901 (see TEACHERS COLLEGE, COLUMBIA UNIVERSITY). The College of Pharmaceutical Sciences offers programs leading to bachelor's, master's, and doctor's degrees. It was chartered in 1829, and became affiliated with Columbia University in 1904.

Other Facilities. The university operates regional institutes, centers, and programs. These offer graduate studies and conduct research in such fields as Communist affairs, computer technology, oceanography, nutrition sciences, urban environment, war and peace studies, and applied social research.

Students operate a daily newspaper and an FM radio station. The university has cooperative programs with many museums, hospitals, libraries, and other institutions in New York City. Butler Library is one of the largest university libraries in the United States. It contains about 4 million volumes, 50,000 periodical titles, rare manuscripts, and historical documents.

History. Columbia was the fifth college founded in the United States in colonial days. King George II of England chartered it as King's College in 1754. King's College stood for many years near the present site of New York City city hall. A medical school was added in 1767, and the buildings were used as a hospital during the Revolutionary War. The school reopened as Columbia College after the war. Columbia moved to a temporary site in midtown New York City in 1857, and planned to move to what is now Rockefeller Center. It never moved there, but Columbia University still owns the land on which Rockefeller Center stands.

Columbia added schools of law and mines, and the faculties of political sciences, philosophy, and pure science. With the founding of the school of architecture in 1896, Columbia became a university. In 1897, the university moved to its present site. For the enrollment of Columbia University, see UNIVERSITIES AND COLLEGES (table). DAN CARLINSKY

See also BARNARD, FREDERICK A. P.; BUTLER, NICHOLAS MURRAY; AMERICAN ASSEMBLY, THE.

COLUMBIAN EXPOSITION. See WORLD'S COLUMBIAN EXPOSITION.

COLUMBIAN ORDER. See TAMMANY, SOCIETY OF.

COLUMBINE is a graceful plant that grows wild in Europe, Asia, and North America. Gardeners plant many kinds as border plants. The common *wild columbine* bears red and yellow nodding flowers on rigid, slender stems. Each blossom of the wild columbine has five long-spurred petals and many large stamens. Bees and hummingbirds like columbine because the flower petals hold large amounts of nectar. The plants grow each year from underground rootstocks and bloom from April to July.

The *Rocky Mountain columbine*, or *blue and white columbine*, is the state flower of Colorado. The blue and white flowers may be 2 inches (5 centimeters) across. The long spurs curve outward and end in tiny knobs. The *short-spurred columbine* bears blue or purple flowers. Their short spurs bend inward and end in a hook.

Scientific Classification. Columbines belong to the crowfoot family, *Ranunculaceae*. The wild columbine is genus *Aquilegia*, species *A. canadensis*. The Rocky Mountain columbine is *A. caerulea*, and the short-spurred columbine is *A. brevistyla*. ROBERT W. HOSHAW

See also FLOWER (picture: Flowers of the Woodland).

COLUMBINE is the young and lively sweetheart of Harlequin in comedy and pantomime. Columbine originated in Italian comedy of the 1500's. See also PANTOMIME; HARLEQUIN; PIERROT.

COLUMBITE, *koh LUM bite*, is a mineral ore. It is an oxide of niobium, iron, and manganese, and has the chemical formula $(Fe,Mn)Nb_2O_6$. It is the chief source of the element niobium. Its composition varies greatly, with the element tantalum (Ta) often taking the place of all or part of the niobium. When there is more tantalum than niobium, the mineral is called *tantalite*. Columbite is black, and occurs in blocklike crystals in coarse granite rocks called *pegmatites*. See also NIOBIUM; TANTALUM. CORNELIUS S. HURLBUT, JR.

COLUMBIUM. See NIOBIUM.

COLUMBUS, Ga. (pop. 167,377; met. area 238,584), is a textile center and the second largest city in the state. Only Atlanta is larger. Columbus is a trading center for the Chattahoochee Valley. A large Army base, Fort Benning, lies 9 miles (14 kilometers) south of Columbus. The city is on the west-central boundary of Georgia, across the Chattahoochee River from Phenix City, Ala. (see GEORGIA [political map]).

Industry and Commerce. Water power helped make Columbus the South's first city to become an industrial center. Water still powers the city's factories. The Chattahoochee River falls 120 feet (37 meters) in a distance of only 3 miles (5 kilometers) near the city, and powers three hydroelectric plants. Cotton-textile manufacturing is the most important industry. Other products include textile machinery, soft drinks, farm implements, marble and granite, brick, tile, wood and paper products, chemicals, candy, and peanut products.

Cultural Activities. Columbus has about 60 public schools. The University of Georgia maintains an off-campus center in Columbus. The city is also the home of Columbus College. Columbus has two public libraries, an art museum, and a symphony orchestra.

History and Government. The Georgia legislature established Columbus on the site of an old Indian village in 1827. It became a cotton-milling center by 1845. The city served as a chief supplier of shoes and swords for Confederate soldiers during the Civil War. Union forces captured Columbus in one of the last battles of the war in April, 1865. Columbus and Muscogee County were consolidated in 1970. Columbus has a council-manager form of government. ALBERT B. SAYE

Aerial Division Aerographics

Columbus is Ohio's capital and second largest city. Columbus' tallest building, the Leveque-Lincoln Tower, *left center*, rises 555 feet (169 meters) near the Scioto River. The State Capitol is nearby.

COLUMBUS, Ohio, is the capital and a leading industrial center of the state. It has a larger area than any other Ohio city and more people than any other except Cleveland. Columbus lies near the center of Ohio, where the Olentangy and Scioto rivers meet. The city is the home of the main campus of Ohio State University, one of the nation's largest universities.

Almost all of Ohio lies within 150 miles (241 kilometers) of Columbus. In 1812, the state legislature chose the site for the capital because it could be reached easily from all major Ohio cities. Many state leaders wanted to name it Ohio City. But General Joseph Foos, a legislator from Franklin County, suggested *Columbus* to honor the explorer Christopher Columbus.

The City covers about 152 square miles (394 square kilometers) and is the seat of Franklin County. The Columbus metropolitan area consists of almost 2,500 square miles (6,470 square kilometers) in Delaware, Fairfield, Franklin, Madison, and Pickaway counties. Columbus has about 25 suburbs and surrounds two of the largest ones, Bexley and Whitehall.

The limestone State Capitol stands in Capitol Square, a 10-acre (4-hectare) park at the intersection of the city's main avenues, High and Broad streets. For a picture of the Capitol, see OHIO (Government).

The Civic Center consists of a group of buildings that covers four blocks on both shores of the Scioto River. The buildings on the west shore include the Veterans Memorial Auditorium and Exhibition Hall. Columbus' tallest building, the Leveque-Lincoln Tower, rises 555 feet (169 meters) on the river's east shore. Other east shore structures include the federal and state office buildings, police headquarters, and City Hall. A bronze statue of Christopher Columbus stands 20 feet (6 meters) high in City Hall Plaza. The city received the statue from the citizens of Genoa, Italy, the explorer's birthplace. The Avenue of Flags runs two blocks south from City Hall Plaza. It features a display of the 50 state flags.

The Ohio state fairgrounds and Ohio State Univer-

FACTS IN BRIEF

Population: 540,025. *Metropolitan Area Population*—1,017,847.

Area: 152 sq. mi. (394 km²). *Metropolitan Area*—2,476 sq. mi. (6,413 km²).

Altitude: 777 ft. (237 m) above sea level.

Climate: *Average Temperature*—January, 30° F. (−1° C); July, 75° F. (24° C). *Average Annual Precipitation* (rainfall, melted snow, and other forms of moisture)—37 in. (94 cm).

Government: Mayor-council. *Terms*—4 years for the mayor and 4 years for the seven council members.

Founded: 1812. Incorporated as a city in 1834.

sity are on the north side of Columbus. German Village, a restored German settlement of the middle 1800's, covers 233 acres (94 hectares) just south of downtown Columbus.

People. About 98 per cent of Columbus' people were born in the United States. People of German and Italian ancestry form large groups in the city. Negroes make up about 18 per cent of the population.

Methodists form the city's largest religious group. Roman Catholic and United Presbyterian congregations also have large memberships.

Church groups, such as the Metropolitan Area Church Board, have been active in the city's fight against racial problems, juvenile delinquency, and poverty. In 1966, members of a Lutheran church on the east side established the East Central Citizens Organization (ECCO). The church helped the ECCO form a neighborhood center that offers legal advice, child care, and tutoring. A neighborhood assembly manages the center and works to solve neighborhood problems.

Another group, the Columbus Metropolitan Area Community Action Organization, helps manage federal, city, and state welfare programs. About 70 welfare agencies work through the United Community Council.

In 1960, Columbus became the nation's first city to build apartment projects for the aged that included special recreational facilities. The city also maintains other recreation centers for elderly citizens.

Economy of Columbus depends heavily on manufacturing and on the federal, state, and municipal governments. About a fourth of the city's workers are employed by the approximately 1,000 manufacturing firms in the area. About a fifth hold government jobs, and almost another fifth work for retail or wholesale stores.

Columbus produces airplane and automobile parts, cement mixers, coal mining equipment, electric appliances, foundry and machine shop materials, refrigerators, shoes, and telephone equipment. Other industries in the city include printing and publishing.

The Battelle Memorial Institute, which conducts scientific research for private industry and the government, has its headquarters in Columbus (see BATTELLE MEMORIAL INSTITUTE). The institute operates the largest independent, nonprofit research laboratories in the world. The Chemical Abstracts Service, the world's largest computer-based chemical information service, also has headquarters in Columbus.

Columbus has two daily newspapers—the *Citizen-Journal* and the *Dispatch*—and eight radio stations and four television stations. Four railroads provide freight service to the city, and passenger trains link Columbus to other cities. Nine airlines use Port Columbus International Airport.

During the 1950's, new suburban shopping centers, restaurants, and theaters began to take business away from downtown Columbus. The construction of seven office buildings, three motels, and an underground parking garage in the early 1960's attracted many people to the city during the day. But night life continued to suffer, and three major theaters and several restaurants closed. Developers hoped to bring larger numbers of people to Columbus with the construction of a convention center during the late 1970's.

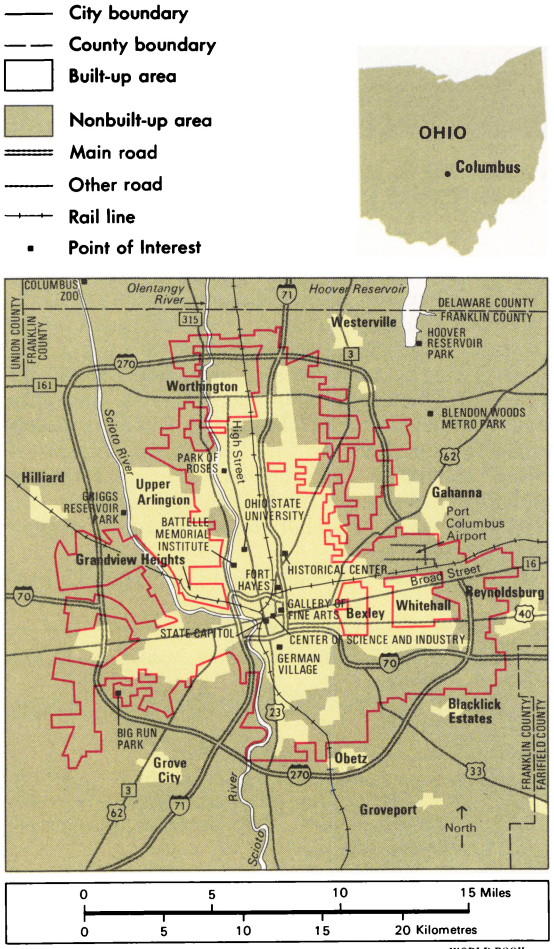
Education. Columbus pioneered in several areas of education. In 1837, the city began the nation's first state school for the blind. The first junior high school in the United States opened in Columbus in 1909. And in 1922, Ohio State University founded WOSU, the first educational radio station in North America.

Today, more than 100,000 children attend about 170 public elementary and high schools and special schools in Columbus. Over a fourth of the students are black. Almost 20,000 students attend the city's 50 private and church-supported schools.

Since 1968, the Columbus Board of Education has made special efforts to involve the community in its work. The board sponsors radio and television shows, holds neighborhood meetings, and publishes reports on the city's schools and their students and staff. In the early 1970's, financial problems forced the board to reduce its career training programs and its special

CITY OF COLUMBUS

Columbus, the state capital, lies in central Ohio and is a major industrial center. The map shows important points of interest in and around Columbus.



Ohio State University

Ohio State University, one of the largest universities in the United States, has more than 300 buildings in Columbus.

classes for handicapped, retarded, and inner-city pupils.

Ohio State University, with about 50,000 students, is one of the largest universities in the United States. Other institutions of higher learning in Columbus include Capital University and Ohio Dominican College. Pontifical College Josephinum, in suburban Worthington, is the only seminary in the Western Hemisphere that is supervised directly by the Vatican. Three other seminaries, three colleges, two business schools, and a technical institute are also in the Columbus metropolitan area.

The Columbus Public Library has 20 branches. It owns more than a million volumes.

Cultural Life. The Columbus Symphony Orchestra performs in the Veterans Memorial Auditorium, and musical comedies are also presented there. The Ohio Theater offers other stage productions.

The Gallery of Fine Arts includes an outstanding collection of oil paintings by George Bellows, who was born in Columbus. Bellows became noted for his paintings of boxing matches and portraits of his family. The Center of Science and Industry includes a planetarium. The Ohio Historical Center has exhibits of Indian life in early Ohio.

The Festival of Arts, held each June in Capitol Square, features displays of architecture and painting, and performances of dance and drama. The state fair, held annually in late August or early September, also provides a showplace for Ohio artists.

Columbus has more than 100 parks and playgrounds, 5 public golf courses, and 3 city reservoirs for swimming and other water sports. The metropolitan Columbus park system consists of seven parks that cover a total of 5,200 acres (2,100 hectares). The Park of Roses displays about 36,000 rose plants. The Columbus Zoo has a section featuring baby farm animals that youngsters may feed and pet.

Government. Columbus has a mayor-council form of government. The voters elect the mayor and seven councilmen to four-year terms. A city income tax provides Columbus with about half its funds.

During the 1960's, the lack of good public transportation became a major problem in the Columbus area. Columbus and nearby cities set up the Central Ohio Transit Authority in 1970 to deal with this problem. The agency purchased Columbus' privately owned bus company.

History. The Delaware and Wyandot Indians lived in what is now the Columbus area before white settlers first arrived. In 1797, settlers founded Franklinton, the first city in the area, on the west side of the Scioto River. The Ohio legislature established Columbus on the east bank, opposite Franklinton, in 1812. Within a year, Columbus had about 300 persons. They included many Germans, and Germans continued to settle on the south side of the city throughout the 1800's. In 1816, the Ohio legislature moved to Columbus from Chillicothe, the temporary state capital. By that year, the city's population had grown to about 700.

During the 1830's, Columbus developed as a transportation and trade center. In 1831, a canal connecting Columbus with the Ohio and Erie Canal opened the way to increased trade with Eastern cities. The National Road, one of the principal pioneer routes to the West, reached Columbus in 1833. The city had about 3,500 persons when it was incorporated in 1834.

The arrival of the railroad in the middle 1800's brought more commerce to Columbus. When the Civil War began in 1861, the city had a population of 18,629. During the war, Columbus became the assembly point for Ohio troops and the site of the largest Northern prison for Confederate soldiers. In 1871, Columbus extended its boundaries and annexed most of Franklinton across the river. By 1900, the city's population had grown to 125,500 and buggy manufacturing had made Columbus the industrial leader of central Ohio.

In 1913, nearly 100 persons died when the Scioto River flooded Columbus. After this flood, the greatest disaster in the city's history, Columbus began a waterfront renewal project. The city built flood walls, bridges, and the beginning of the Civic Center.

In the 1900's, Columbus continued growing in both population and area. Its population jumped from 290,500 in 1930 to more than 471,000 in 1960. Between 1960 and 1970, Columbus grew from the third to the second most populated city in Ohio. Maynard E. Sensenbrenner, who served as mayor during most of the 1950's, 1960's, and early 1970's, developed a policy of annexing an average of $6\frac{1}{2}$ square miles (17 square kilometers) of unincorporated land each year.

During the 1960's, Columbus citizens and developers began an urban renewal program. The German Village Society hired a private developer to rebuild the south side's German Village, which had been in poor condition since the early 1900's. Several old buildings were rebuilt or replaced as part of downtown renewal projects. New construction, costing more than $100 million, included seven office buildings, two high-rise apartment buildings, and three motels. A 41-story, $150-million state office building was completed in 1975. Other plans for the 1970's included the construction of a downtown convention center.

WILLIAM S. KEESEE

The Metropolitan Museum of Art, New York City, Gift of J. Pierpont Morgan, 1900

Christopher Columbus discovered America in 1492. He has been painted by many artists, but the paintings differ widely in showing how he looked. This portrait was painted by Sebastian del Piombo of Italy. After Columbus' first voyage to America, the king and queen of Spain granted him the privilege of bearing a coat of arms, *above.*

CHRISTOPHER COLUMBUS

COLUMBUS, CHRISTOPHER (1451-1506), was one of the greatest seamen and navigators of all time. He is called the discoverer of America, though Indians had lived in both North and South America for thousands of years before Columbus arrived in 1492. In addition, Norsemen had explored the coast of North America about A.D. 1000. But in the 1400's, Europeans did not know that this continent even existed. Columbus' landing in the West Indies led to lasting contact between Europe and the Western Hemisphere.

Years of Preparation

Early Life. The exact date of Columbus' birth is not known. He was born sometime between August 25 and October 31, 1451, in Genoa, then the capital of an independent Italian republic. The family name was *Colombo.* In English, he is known by the Latin form of his name, *Columbus.* He called himself *Cristóbal Colón* after he settled in Spain. His father, Domenico Colombo, was a wool weaver who took a leading part in the affairs of his local guild. His mother, Susanna Fontanarossa, was the daughter of a wool weaver.

Christopher was the eldest of five children. The next brother, Bartholomew, planned the great voyage with Christopher and became his right-hand man in all his enterprises. The youngest brother, Diego, helped him to rule Hispaniola.

As a youth, Christopher helped his father at the loom. But he had always longed to go to sea. Genoa was an important seaport. Genoese ships traded through the Mediterranean region, and many small boats sailed between Genoa and other coastal towns. Christopher undoubtedly caught a ride aboard some of these boats when he was young and learned how to handle oars and sails.

He had little schooling. The Genoese dialect that he spoke was almost a different language from Italian. When he went abroad and had to speak Spanish, he learned to read and write it. He also taught himself Latin because geography books were written in Latin. No record is left about what sort of boy he was. But judging from his later life, he was dreamy and sensitive.

Early Voyages. The chance to go to sea came sometime between his nineteenth and twentieth birthdays, when he shipped aboard a Genoese galley. The galley had been chartered by King René of Provence to punish the Barbary pirates. After that Columbus made one or two voyages to the island of Chios in the Aegean Sea. Then came a voyage that almost cost him his life. His ship, the *Bechalla,* formed part of a convoy bound from Genoa to England. On August 13, 1476, the convoy

Samuel Eliot Morison, the contributor of this article, is a former professor of history at Harvard University and winner of a Pulitzer prize for his biography of Christopher Columbus, Admiral of the Ocean Sea.

Models courtesy of the Museum of Science and Industry, Chicago (WORLD BOOK photos)

Columbus' Ships on his first voyage to the New World were the *Santa María*, the *Niña*, and the *Pinta*. No one knows what they looked like, but the models shown here represent one scholar's idea. The *Santa María*, above, probably was from 75 to 90 feet (23 to 27 meters) long. The *Niña*, *below left*, and the *Pinta*, *below right*, were probably about 70 to 75 feet (21 to 23 meters) long.

was attacked by a hostile fleet off Lagos, Portugal. Christopher was wounded and his ship sank. Jumping into the sea, he grabbed a long oar. Using the oar as a life preserver, he managed to reach shore. A few months later he was on a Portuguese vessel which stopped at Galway in Ireland. The vessel sailed north of Iceland in February, 1477, before returning to Lisbon.

By the spring of 1477, Christopher was in Lisbon, the liveliest city in Europe. There his brother, Bartholomew, kept a shop which sold charts and nautical instruments. The Portuguese had discovered the Azores, colonized the Madeiras, and sailed down the coast of Africa almost to the equator. They had invented a handy type of ship, the caravel, which could gain ground against the wind instead of merely scudding before it (see CARAVEL). They were trying to reach the Indies (which at that time meant India, China, the East Indies, and Japan) by sailing around Africa. What they wanted in the Indies were gold, gems, drugs and spices, which reached Europe only by long, costly, overland caravans. While the Portuguese seamen were trying to reach the Orient the hard way, around Africa, Columbus thought of what he believed to be the easy way, sailing due west.

The Great Idea

What Columbus Wanted to Do. Columbus was not trying to "prove the world was round," as so often has been said. He didn't have to. Thinking people knew the world was round. Columbus was simply trying to find a short sea route to the Indies. Paolo Toscanelli, a learned man of Florence with whom Columbus corresponded, believed that Japan lay only 3,000 nautical miles (5,600 kilometers) west of Lisbon, Portugal. Columbus expected, by sailing 2,400 nautical miles (4,400 kilometers) west along the latitudes of the Canary Islands, to reach a group of islands near Japan where the natives would accept him as lord and master. There he planned to establish a great city for trading the products of the East and the West. In the Philippine Islands, which the Spaniards occupied some 60 years after his death, his dream was achieved.

First Attempts to "Sell" His Plan. Columbus had a hard time selling his simple plan because the learned men to whom it was referred had a more nearly correct idea of the size of the world than he. The airline route from the Canaries to Japan is about 11,000 nautical miles (20,400 kilometers). Columbus wrongly estimated the size of the globe and the width of the Atlantic. This mistake made him think that Japan was about where the Virgin Islands are located.

Columbus asked for a great deal. He wanted three ships equipped and maintained at the king's expense, a large share in the trade, the governorship of any lands he might discover, the title of Admiral, and noble rank. He wanted all these privileges to be passed on to his sons. None of the Portuguese explorers had asked for so much. King John II of Portugal did not care to invest in an enterprise which his experts declared to be impractical, so he refused Columbus' request in 1482.

In the meantime, Columbus had traveled to Madeira and the Gulf of Guinea in Portuguese ships, and had become a captain. About 1479 he married a Portuguese lady, Felipa de Perestrello. They lived in the Madeiras. Felipa died shortly after their only child, Diego, was born. She was buried in the Carmo church in Lisbon.

Success in Spain. In 1485 Columbus went to Spain to offer his services to King Ferdinand and Queen Isabella, at the same time Bartholomew was trying to interest Henry VII of England and Charles VIII of France. Christopher took little Diego from Portugal to Spain. About 5 miles (8 kilometers) from Palos was a Franciscan friary called *La Rábida*, which conducted a school for boys. Columbus decided to leave Diego there while he went to court. Father and son made the long walk together. At the door of La Rábida they ate a piece of bread and drank a jug of water. While arrangements were being made to leave Diego, Columbus met Friar Antonio de Marchena, who became his loyal supporter and recommended him to Queen Isabella.

The queen, a handsome and intelligent young woman, was sympathetic and put Columbus on the royal payroll. Her experts, however, took the same view of his plan as did the Portuguese. Besides, Ferdinand and Isabella were busy fighting the Moors. Not until they had conquered Granada, the last Moorish stronghold in Spain (January 2, 1492), were they ready to do business. The experts told the sovereigns to dismiss Columbus, but Louis de Santangel, the royal treasurer, persuaded the queen that she was missing a great opportunity. She sent for Columbus at once, and even offered to pawn the crown jewels to raise money. But the treasurer supplied most of the funds (about $14,000) to fit out the fleet. Isabella kept her jewelry and won a new world.

Columbus was riding a mule homeward when the queen's messenger caught up with him. He was given everything he asked for—ships, honors, titles, and percentage of trade. No discoverer was ever promised so much before his performance. No discoverer's performance so greatly exceeded his promise.

First Voyage to America

Ships and Crew. Columbus had three vessels on his first voyage. They were the *Santa María* and two smaller vessels, the *Pinta*, and the *Niña*. The vessels in which Columbus sailed on all his voyages were made of wood and had no engines or motors, and very few comforts, as compared to the great ocean liners of today. The *Santa María* was manned by 40 men, the *Pinta* by 26 men, and the *Niña* by 24 men. There were bunks for only a few of the officers. The cooking was done with wood in a firebox on deck. These ships had good compasses, but no log to measure distance and no instrument for "shooting a star" except a crude quadrant that was not accurate when the ship rolled. Columbus navigated by dead reckoning. He knew just enough celestial navigation to measure latitude from the North Star (see LATITUDE).

Sailing Westward. The fleet sailed from Palos, Spain, Aug. 3, 1492. Nine days later it reached the Canary Islands. The sailors loaded provisions there, and made repairs. The ships left San Sebastian September 6. The last land sighted was Hierro, one of the Canary Islands, on September 9. Columbus set the course due west. He had fair trade winds and smooth seas most of the way across. The only trouble came from the crew. For the most part they were honest men, and there is no evidence that they feared "falling off the edge of the earth." But they were afraid they would be unable to beat back

against the wind which always seemed to blow from the east. After three weeks of sailing, the longest anyone had ever sailed in one direction out of sight of land, it was hard for Columbus to persuade them to carry on. "The Admiral cheered them as best he could, holding out good hope of the advantages they might have," wrote his earliest biographer. He told the crew that he "had sailed to go to the Indies and would continue until he found them, with the Lord's help." Either he or Captain Pinzon of the *Pinta* cried "*Adelante! Adelante!*" (*Sail on! Sail on!*)

The Discovery. On October 10, everyone agreed to sail on for three more days and then return if land were not found. The island which Columbus named San Salvador, in the Bahamas, was sighted by moonlight at 2 A.M. October 12. Before noon that day Columbus landed on the beach at Fernandez Bay and took possession of a New World (as it proved to be) for Spain. He believed and always insisted that this was an island of the Indies, near Japan or China. He also believed that the gentle Arawak, who offered the "men from Heaven" all they had, were Indians (see ARAWAK INDIANS). Men knew within 30 years that Columbus was wrong, but everyone has continued to call the native inhabitants of America "Indians" and the islands he first reached, the "West Indies."

The three ships stayed only a few days at San Salvador. On Oct. 28, 1492, the fleet entered the Bay of Bariay, off Cuba, which Columbus believed to be part of China. They explored ten or twelve harbors from Punta Brava to Cape Maisí, and sent men up-country to Holguín in the hope that this native village was Peking, and that they could present a letter from Ferdinand and Isabella to the emperor of China. They found no emperor but saw natives smoking cigars—the first time Europeans had seen tobacco. From Cape Maisí the fleet crossed the Windward Passage and sailed along the north coast of the island of Hispaniola. The climate and trees reminded Columbus so much of Spain that he named it *La Isla Española* (the Spanish Island).

On Christmas Eve the *Santa María* was wrecked on a reef near the present Cap-Haïtien, in the Republic of Haiti. The local Indian chief helped save the cargo and seemed so friendly that Columbus decided to build a fort and leave forty men to hunt for gold. Columbus then started home on the *Niña*, sailing from Samaná Bay, Jan. 16, 1493. With him he took several Indians he had captured.

The Hard Voyage Home. The homeward voyage was very rough. The *Niña* and the *Pinta* were separated in a storm west of the Azores. The *Niña* so nearly sank that Columbus sealed up an account of his discoveries in a cask and threw it into the water. The *Niña* called at the Portuguese island of Santa Maria in the Azores. There the governor thought Columbus was lying and that he had been poaching in Africa. He arrested Columbus' crew on their way to church, but let them go when Columbus threatened to shoot up the town. On its way to Spain the *Niña* was overtaken by another storm that ripped off most of its sails and forced it into Lisbon. There Columbus had the satisfaction of visiting King John II and exhibiting the Indians who had survived the voyage. The *Niña* finally reached its home port of Palos March 15, 1493. Later the same day the *Pinta* also arrived at Palos.

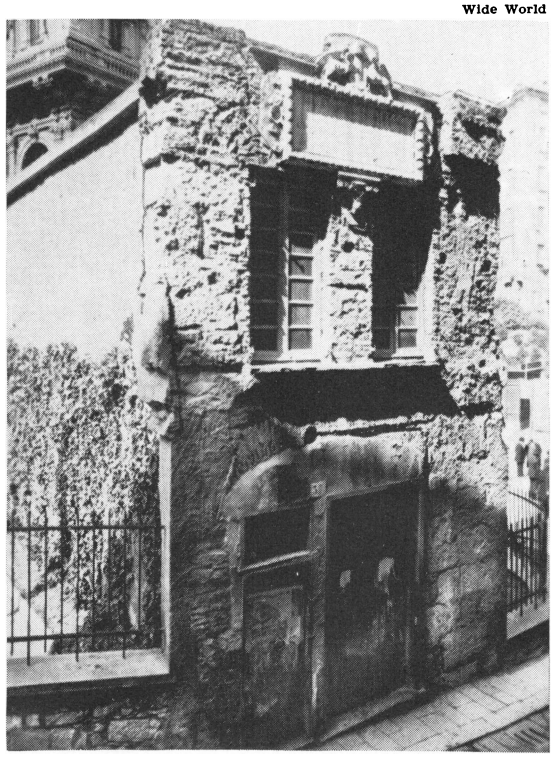
Triumphant Return to Spain. Columbus rode horseback across Spain, with some of his officers and the captive Indians, to report to Ferdinand and Isabella at Barcelona. They gave him a grand reception, and confirmed his title of *Admiral of the Ocean Sea*, which meant that he had the right to judge admiralty cases (piracy, shipwreck, wage disputes, and the like) anywhere in the Atlantic Ocean. He also was given the title *Viceroy of the Indies*. He was ordered to organize a second voyage, to colonize Hispaniola and explore further.

Later Voyages

Second Voyage to America. On his second voyage, Columbus commanded 17 ships, carrying about 1,000 colonists, all men, to the New World. This "handsome fleet," as the Admiral called it, sailed from Cadiz, September 25, called at the Canaries, and made the ocean crossing in the excellent time of 21 days. They reached the West Indies Nov. 3, 1493, at an island Columbus named *Mariagalante* after his flagship. The fleet passed Dominica, Guadeloupe, Antigua, Nevis, St. Christopher, St. Croix, Puerto Rico, and other islands. In three weeks' sailing they reached Cap-Haïtien. All the men Columbus had left there the previous Christmas had been killed by the Indians, whom they had mistreated. When Columbus heard this sad news, he turned eastward and founded Isabela, on the north coast of Hispaniola. This was the first European

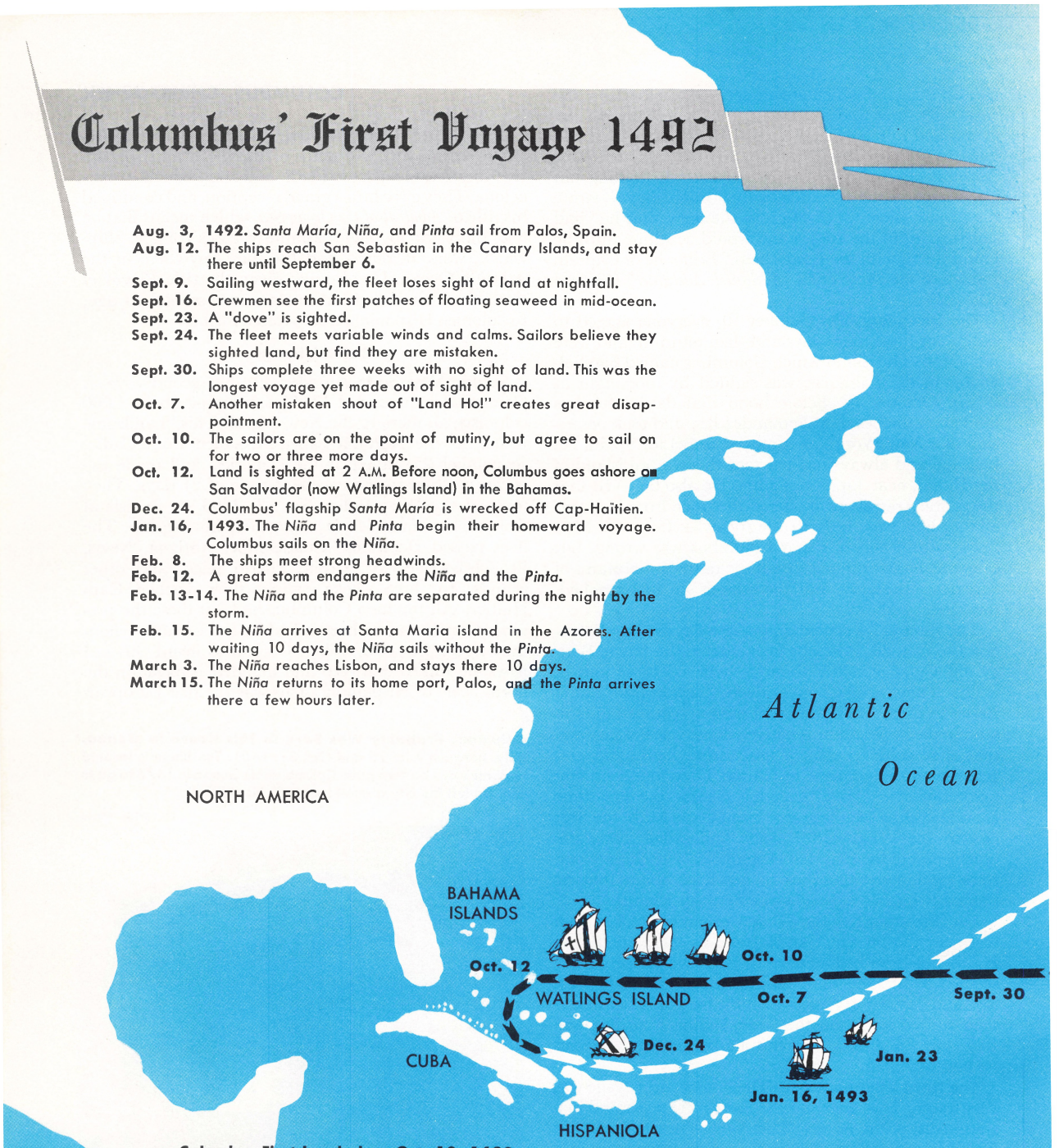
Columbus Probably Was Born in This House in Genoa, Italy, between Aug. 25 and Oct. 31, 1451. The house is located near the city's eastern gate. Columbus left Genoa in 1476 to go to sea. He left the city a small legacy in his will.

Wide World

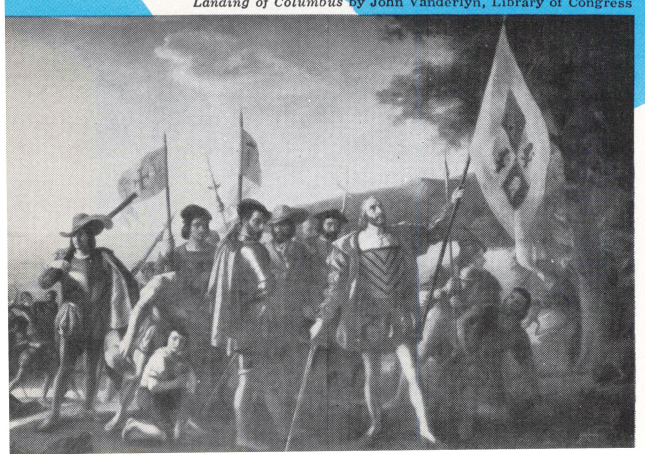


Columbus' First Voyage 1492

Aug. 3, 1492. *Santa María, Niña,* and *Pinta* sail from Palos, Spain.
Aug. 12. The ships reach San Sebastian in the Canary Islands, and stay there until September 6.
Sept. 9. Sailing westward, the fleet loses sight of land at nightfall.
Sept. 16. Crewmen see the first patches of floating seaweed in mid-ocean.
Sept. 23. A "dove" is sighted.
Sept. 24. The fleet meets variable winds and calms. Sailors believe they sighted land, but find they are mistaken.
Sept. 30. Ships complete three weeks with no sight of land. This was the longest voyage yet made out of sight of land.
Oct. 7. Another mistaken shout of "Land Ho!" creates great disappointment.
Oct. 10. The sailors are on the point of mutiny, but agree to sail on for two or three more days.
Oct. 12. Land is sighted at 2 A.M. Before noon, Columbus goes ashore on San Salvador (now Watlings Island) in the Bahamas.
Dec. 24. Columbus' flagship *Santa María* is wrecked off Cap-Haïtien.
Jan. 16, 1493. The *Niña* and *Pinta* begin their homeward voyage. Columbus sails on the *Niña*.
Feb. 8. The ships meet strong headwinds.
Feb. 12. A great storm endangers the *Niña* and the *Pinta*.
Feb. 13-14. The *Niña* and the *Pinta* are separated during the night by the storm.
Feb. 15. The *Niña* arrives at Santa Maria island in the Azores. After waiting 10 days, the *Niña* sails without the *Pinta*.
March 3. The *Niña* reaches Lisbon, and stays there 10 days.
March 15. The *Niña* returns to its home port, Palos, and the *Pinta* arrives there a few hours later.



Columbus First Landed on Oct. 12, 1492.
Landing of Columbus by John Vanderlyn, Library of Congress



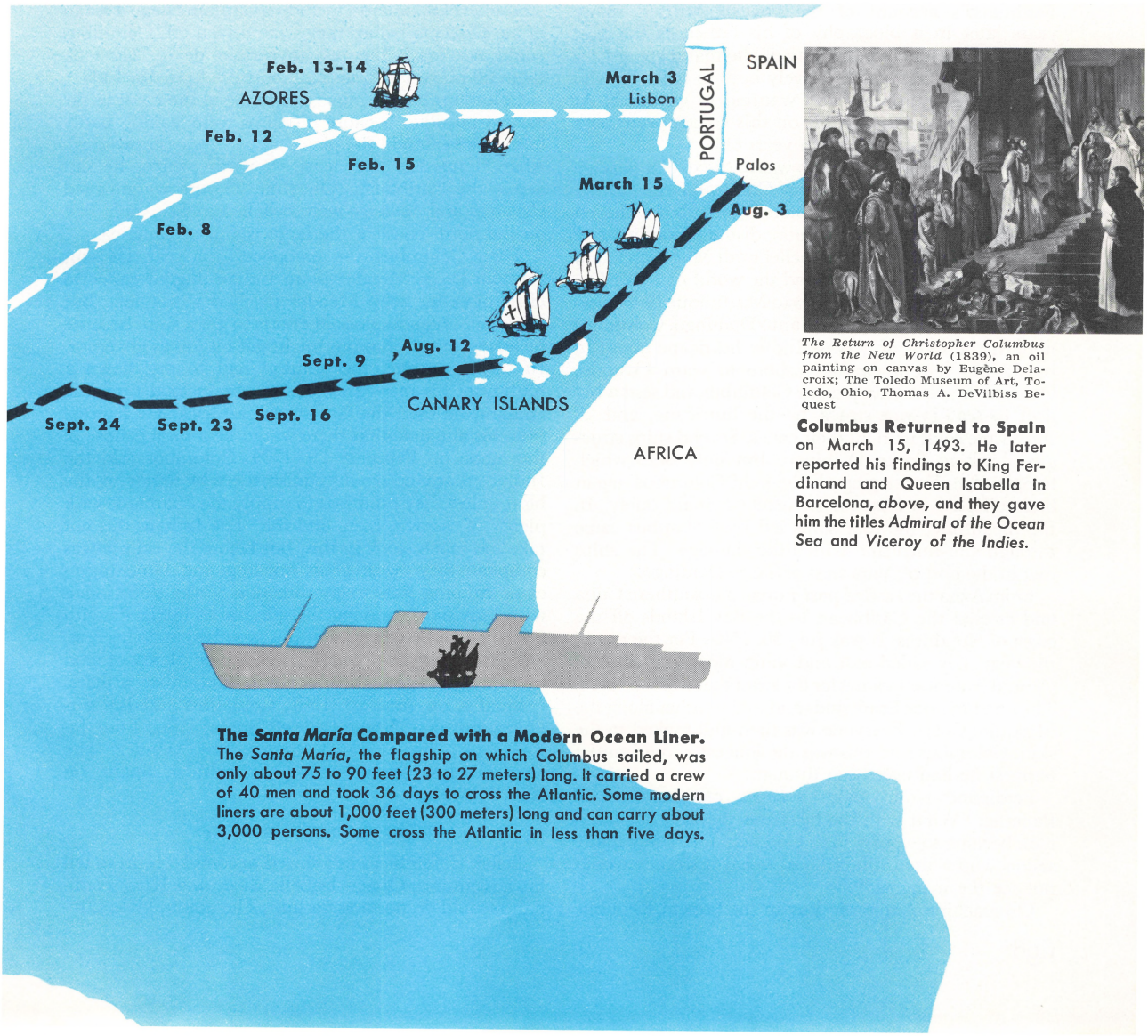
colony in America. Leaving his brother Diego in charge, he took the *Niña* and two caravels to explore the southern coast of Cuba during the summer of 1494.

On the same voyage he discovered Jamaica. Returning to Isabela, he found the colonists fighting among themselves and with the Indians. After defeating the Indians and restoring order, he returned to Spain in June, 1496.

In Spain, Columbus found that many Spaniards who had returned from the New World complained that he was a cruel taskmaster. This was not true. He had been too lenient. The Spaniards were not satisfied and said there was no gold in Hispaniola. There was some, but not enough to satisfy them. The king and queen believed Columbus. They sent new men and supplies to the colony. They also gave Columbus one ship and two small caravels, to make a third voyage of discovery.

Third Voyage to America. Columbus departed from Sanlúcar, Spain, on May 30, 1498. He selected a southerly route, thinking it would lead him to lands where more gold could be found. The fleet ran into the doldrums around 9° north latitude and was becalmed for eight days, while the men suffered from the heat (see DOLDRUMS). Then the southeast trade wind sprang up and carried the three ships to the island of Trinidad, on July 31. Sailing through the treacherous Serpent's Mouth, they crossed the Gulf of Paria to the coast of Venezuela. In one of the little harbors on the Paria Peninsula (probably Yacua) on Aug. 5, 1498, Columbus went ashore, possibly the first time since the 1000's that Europeans set foot on the American continent. "I believe that this is a very great continent which until today has been unknown," wrote Columbus in his journal. He called the continent an "Other World."

Columbus in Disgrace. The prediction of Columbus proved true, but it did not help him. He found the Hispaniola colony seething with discontent because there was not enough gold to make everyone rich in a year. The Spaniards claimed they could not eat "Indian food" like corn and cassava. He tried to quiet the rebels by giving them land and letting them enslave the Indians to work it, but that failed to satisfy many. Large numbers went home, where they demanded back pay and the Admiral's head. Columbus' son, Diego, and his



Columbus Returned to Spain on March 15, 1493. He later reported his findings to King Ferdinand and Queen Isabella in Barcelona, *above*, and they gave him the titles *Admiral of the Ocean Sea* and *Viceroy of the Indies*.

The Return of Christopher Columbus from the New World (1839), an oil painting on canvas by Eugène Delacroix; The Toledo Museum of Art, Toledo, Ohio, Thomas A. DeVilbiss Bequest

The *Santa María* Compared with a Modern Ocean Liner. The *Santa María*, the flagship on which Columbus sailed, was only about 75 to 90 feet (23 to 27 meters) long. It carried a crew of 40 men and took 36 days to cross the Atlantic. Some modern liners are about 1,000 feet (300 meters) long and can carry about 3,000 persons. Some cross the Atlantic in less than five days.

second son, Ferdinand, whose mother was Beatriz Enríquez de Harana, were pages at court. Whenever they appeared in the streets they were followed by a gang of rascals shouting, "There go the sons of the Admiral of the Mosquitoes, of him who discovered lands of vanity and delusion, the grave and ruin of Spanish gentlemen!"

In 1500, King Ferdinand and Queen Isabella sent Francisco de Bobadilla to settle the troubles at Santo Domingo, the new capital of Hispaniola. He put Columbus and his two brothers in chains and shipped them to Spain for trial. There they were released by order of the king and queen. But Ferdinand and Isabella sent out Ovando as governor of Hispaniola. Ovando took a fleet of thirty ships and 1,500 new colonists.

Fourth and Last Voyage. As a last chance to regain his fortunes, the Admiral asked for ships to make a new voyage of discovery. This the king and queen granted, mainly to get rid of him. On May 9, 1502, Columbus set sail on his fourth, last, and most adventurous voyage to America. He commanded four caravels, *La Capitana*, *Santiago de Palos*, *La Gallega*, and *Vizcaína*.

His 13-year-old son, Ferdinand, went with him. Ferdinand's account of the voyage, written many years later in a biography of his father, is the best we have. Ferdinand had plenty of playmates aboard, for his father preferred strong, lively boys to old salts who were always grumbling and wanting to go home. At least one-third of the people on this voyage were boys between twelve and eighteen years old.

The purpose of this voyage was to discover a passage to the Indian Ocean between Cuba and the "Other World" found four years before. Columbus believed that South America lay a short distance southeast of China. This was a common belief until Magellan's ship returned from a voyage around the world in 1522. The fleet crossed from the Canaries to Martinique in twenty-one days, and then sailed to Santo Domingo. Columbus noticed the signs of a West Indies hurricane about to break and sent a captain ashore to warn Ovando. Ovando, however, laughed at Columbus and sent a big fleet to sea. It was struck by the hurricane, and 20 ships were sunk with all their crews. Several ships struggled back to Santo Domingo. But only one, which happened to be carrying all the gold Columbus' agent had collected in Hispaniola, reached Spain safely. In the meantime, the four ships led by Columbus came through the hurricane with little damage. The ships met in the port of Azua west of Santo Domingo.

From Azua they sailed past Jamaica to southern Cuba and crossed the Caribbean to the Bay Islands off the coast of Honduras. It was July 30, 1502. For the rest of the year they sailed east and south along the coast of Central America, looking for the strait that was not there. They had to buck headwinds and foul weather along the Mosquito Coast. Everyone was tired and soaked to the skin. Columbus said this was the longest and grimmest tempest he had ever been through.

Ferdinand wrote about a storm off the coast of Panama: "What with the heat and the wet, our hardtack became so wormy that, God help me, I saw many sailors who waited till darkness to eat it so they would not see the maggots."

On reaching Almirante Bay in the present Republic of Panama, Columbus learned that another ocean lay only a few days' march across the mountains. But he had not found a strait leading to that ocean. He spent New Year's Day, 1503, anchored off the site of the present United States Naval Base at Coco Solo, Canal Zone. But the explorers never learned how near the Pacific Ocean was.

The Indians of Costa Rica and Panama were more civilized than any that Europeans had met before. Columbus, by trading cloth, beads, and various small wares, obtained a valuable load of copper and gold objects such as masks, great disks, and bird-shaped pendants. After passing Porto Bello and finding no strait, he turned westward again and tried to found a colony in the province of Veragua where gold was plentiful and easy to mine.

The local Guaymi Indians were willing to trade, but did not want the Spaniards as permanent guests. The local chief, El Quibián, was friendly at first, but soon got ugly. Bartholomew, Columbus, and Diego Méndez captured El Quibián as a hostage. The Indian chief jumped overboard and escaped. Then he led his warriors to attack the village that the Spaniards were building beside the Belén River. The Indians killed a number of Spaniards, including Captain Diego Tristán of the *Capitana* before they were driven off. Columbus could not leave the rest to certain death. He took them all aboard and started home on April 16, 1503.

Columbus had to move slowly along the coast as far east as possible, because his ships were leaking badly from holes eaten in the planking by *teredos* (shipworms). Abandoning the two least seaworthy ships, he cut across the Caribbean. On June 25, the waterlogged *Capitana* and *Santiago* were beached at St. Ann's Bay on the north coast of the large island of Jamaica.

There Columbus was marooned for a year. He sent Captain Diego Méndez in an Indian dugout canoe to Hispaniola for help. Méndez reached Hispaniola, but Governor Ovando blocked efforts to get a ship, because he feared that Columbus might get his job as governor. In the meantime, the admiral had to put down a mutiny of his men. In order to obtain food from the Indians, he used the famous eclipse trick. He learned from his almanac that there would be a total eclipse of the moon on February 29, 1504. Columbus told the Indians that God would punish them by removing the light unless they promised to supply the Spaniards with plenty of cassava, corn, and fish. The Indians did not take too much stock in this, but before the eclipse was complete they "with great howling and lamentation came running from every direction to the ships laden with provisions, praying the admiral to intercede with God on their behalf." Columbus promised to do his best, and after that the Spaniards were given plenty of food in return for glass beads, rings, and other articles.

Finally, on June 29, 1504, Columbus and 100 survivors, out of 135 who had left Spain, sailed from Jamaica in a little caravel chartered by Méndez. The admiral's last voyage ended at Sanlúcar, Spain, on Nov. 7, 1504.

The Admiral's Last Days

Before Columbus was allowed to come to court to tell his adventures, Queen Isabella died, and King Ferdinand would do nothing for him. The admiral was fifty-

three years old and in failing health. He had suffered from arthritis during the last two voyages and now could scarcely move. He had enough money to live on, but wanted the governorship and his rightful share in American trade restored to him. The few remaining months of his life were spent either in bed or painfully traveling by muleback to be near the king in the hope he would relent. On May 20, 1506, in a humble dwelling at Valladolid, the "Admiral of the Ocean Sea" died. With him at the end were his two sons, Captain Méndez, and a few faithful servants. He was buried in Valladolid. His grandson took his remains to Santo Domingo. The tomb in the cathedral of Seville covers the ashes of his son Diego.

Estimates of Columbus

Columbus was described in 1501 as "a tall man and well built, ruddy, of a great creative talent, and with a long face." His son Ferdinand added: "He had an aquiline nose and his eyes were light in color: his complexion too was light, but kindling to a vivid red. In youth his hair was blond but when he came to his thirtieth year it all turned white." He was simple in dress, and moderate in eating and drinking. His manners were pleasant but dignified.

Columbus had a mystic belief that God intended him to make great discoveries in order to spread Christianity. He said his prayers several times daily and attended Mass whenever possible. Although he often seemed greedy for money and titles, it was to save his descendants from the poverty he had endured as a young man. As a seaman, he was one of the greatest in history. Anyone could have reached America by sailing west long enough, but few men with the means Columbus had could have found the way back to Spain, or have reached the desired island on later voyages. Columbus had great moral and physical courage. Again and again, he faced mutinous sailors, armed rebels, frightful storms, and fighting Indians without flinching. His tenacity was so great as to be a fault. A man of one idea, and that a radical one, he was regarded as tiresome by most people and was hated by many. Also he had an unfortunate habit of saying "I told you so" about the success of his first voyage, which made some people eager to trip him up.

Columbus' voyage to America ranks among history's most important events. It led to lasting contacts between Europe and America and opened new windows to science and to all knowledge. To few men in modern history does the world as we know it owe so great a debt as to Christopher Columbus. SAMUEL ELIOT MORISON

Related Articles in WORLD BOOK include:
Caravel
Cattle (History)
Columbus Day
Exploration and Discovery (The Sea Route to India)
Ferdinand V
Flag (pictures: Flags in American History)
Haiti (History)
Isabella I
Latin America (Exploration; map)
Map (Map Making in Europe)
Vespucci, Amerigo
Virgin Islands (Exploration)

Outline

I. Years of Preparation
A. Early Life
B. Early Voyages
II. The Great Idea
A. What Columbus Wanted to Do
B. First Attempts to "Sell" His Plan
C. Success in Spain
III. First Voyage to America
A. Ships and Crew
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E. Triumphant Return to Spain
IV. Later Voyages
A. Second Voyage to America
B. Third Voyage to America
C. Columbus in Disgrace
D. Fourth and Last Voyage
V. The Admiral's Last Days
VI. Estimates of Columbus

Questions

What did Columbus hope to prove by making his first voyage?
Why did Columbus have such a hard time "selling" his plan for a voyage westward?
How did Queen Isabella get money to send Columbus on his first voyage?
What were the names of the three ships Columbus took on his first voyage to America? How many men accompanied Columbus on the first voyage?
What did Columbus hope to find on his last voyage?
How many voyages did Columbus make to America?
How did Columbus once use the "eclipse trick" to obtain food from the Indians?
How much did Columbus know about celestial navigation?
When Columbus spoke of "the Indies," what countries did he mean?
Why did Columbus once threaten to shoot up a Portuguese village?

COLUMBUS, KNIGHTS OF. See KNIGHTS OF COLUMBUS.

COLUMBUS COLLEGE. See UNIVERSITIES AND COLLEGES (table).

COLUMBUS DAY honors Christopher Columbus' first voyage to America in 1492. Columbus Day is a legal federal holiday throughout the United States. Until 1971, it was celebrated on October 12, but it is now celebrated on the second Monday in October. Cities and organizations sponsor parades and hold banquets.

The first Columbus Day celebration was held in 1792, when New York City celebrated the 300th anniversary of the landing. In 1892, President Benjamin Harrison called upon the people of the United States to celebrate Columbus Day on the 400th anniversary of the event. Columbus Day has been celebrated annually since 1920.

Although the land Columbus reached was not named after him, many monuments honor him. The Republic of Colombia in South America bears his name. So do towns, rivers, streets, and public buildings. The name *Columbia* has also been used as a poetic personification of the United States (see COLUMBIA). The Columbus Memorial Library in Washington, D.C., contains 90,000 volumes on the 21 American republics.

Many Latin-American countries celebrate October 12 as the *Día de la Raza* (Day of the Race). It honors the Spanish heritage of the peoples of Latin America. Celebration ceremonies feature speeches, parades, and colorful fiestas. ELIZABETH HOUGH SECHRIST

COLUMN

COLUMN, *KAHL um*, is a vertical structure or pillar designed chiefly to support a weight above. It usually serves both to strengthen and to decorate a building. It may be constructed of any material, such as stone, wood, metal, marble, or brick. A typical column consists of three parts, the *base*, *shaft*, and *capital*. The shaft is the central upright portion. It is usually cylindrical in shape, but it may be modeled on any regular geometrical figure. The base forms the lowest part. It supports the shaft, which is crowned by the capital.

Early architecture used various kinds of columns. The Egyptians favored the heavy, massive type of column, represented by the great central pillars of the Hall of Karnak (see EGYPT, ANCIENT [color picture: The Temple of Amon-Re at Karnak]). The Persian column, like the Greek, was generally tall and slender.

The Greek Orders. The Greeks developed the column to a high degree. Their styles of base, shaft, and capital may be separated into three classic orders of architecture: Doric, Ionic, and Corinthian.

The Doric Column is the oldest and simplest of the three types. It has a plain shaft without a base, which tapers slightly upward, the height from 5 to 7 times its lower diameter. Along the shaft, 16 to 20 vertical, shallow grooves, or *flutes*, meet in sharp edges. The capital has two parts of equal thickness. The upper, a square block, or plinth, called the *abacus*, rests on the lower, a circular pillowlike tablet called the *echinus*. Above the capital is the *entablature*, which consists of three parts. The most celebrated example of Doric architecture is the stately Parthenon, on the Acropolis of Athens (see GREECE, ANCIENT [color picture: The Parthenon in Athens]; PARTHENON).

The Ionic Column was invented by the Asiatic Greeks. It is a more slender, graceful, and decorative structure than the Doric. Its shaft rises from a circular or polygonal base to a capital adorned with an echinus and *volutes* (scrolls) connected by a horizontal band. Its height ranges from 7½ to 9½ times its diameter. Along the shaft are 24 flutes, separated by narrow *fillets* (flat surfaces). Among the finest examples of Ionic columns is the Erechtheum at Athens (see ACROPOLIS).

The Corinthian Column is the most ornamental. A variation of Ionic, it has a slender, fluted shaft but a more elaborate capital. The capital consists of a bell-shaped core surrounded by two or three rows of acanthus leaves (see ACANTHUS). Above these leaves, pairs of branching scrolls meet at the corners in spiral volutes. The monument of Lysikrates at Athens is an example.

The Roman Orders. The column became an architectural feature of wonderful variety and beauty under the Romans. Five orders are usually assigned to them: Tuscan, Doric, Ionic, Corinthian, and Composite.

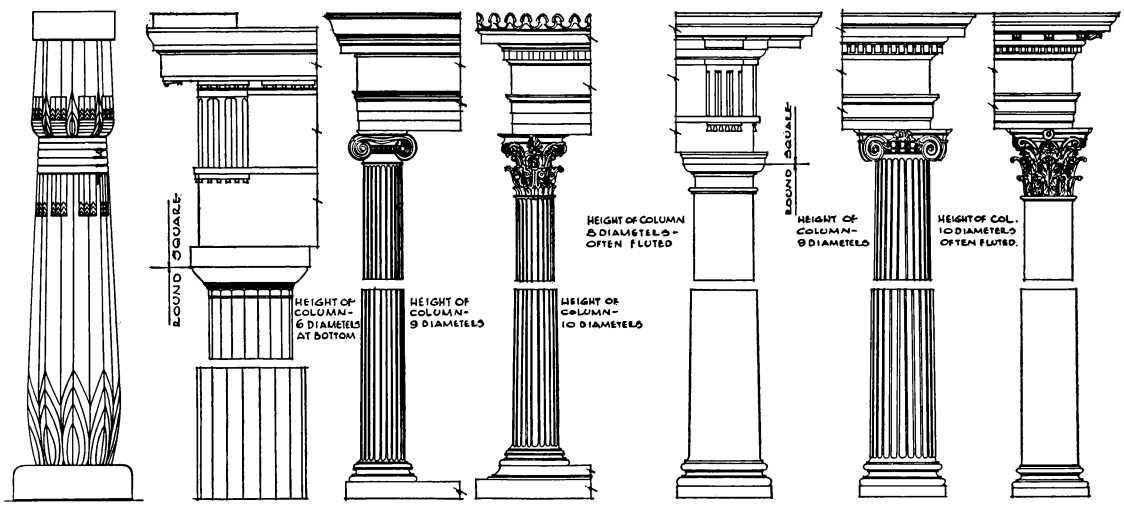
The *Tuscan* is an elementary Doric, with a column seven diameters in height. The *Roman Doric* column is borrowed from the Greek. It generally has a simple molded base that rests on a square plinth. The Romans adopted the Greek Ionic with little change. But the Corinthian was enriched and elaborated to become a distinct Roman order. The Romans added the *Composite* to these four. The Composite combined elements of the Ionic and Corinthian orders.

The Romans favored columns designed to serve as memorials to famous persons and events. They erected massive towerlike columns fitted with interior staircases. A famous example is Trajan's Column in Rome.

Columns of Later Periods. In early Christian and medieval European architecture, the column was used freely and in a variety of forms. Most of the capitals come from the Corinthian and are called *Corinthianesque*. The interior of the Cathedral of Notre Dame in Paris uses a combination of arch and shaft. The Renaissance revived Roman-style columns. The colonnades of Saint Peter's Church in Rome are of special note. Architecture today has adopted classic and Renaissance columns to give an effect of grandeur. The Treasury Building in Washington, D.C., is an example. KENNETH J. CONANT

See also pictures of columns with ARCHITECTURE; POMPEII; ROME; VATICAN CITY.

COLUMNIST. See JOURNALISM (Special Assignments).



Columns Used in Early Architecture include, *left to right*, an Egyptian column; the three Greek orders, Doric, Ionic, and Corinthian; and the three Roman orders adapted from the Greeks. Examples of the Doric and Ionic columns can be seen on the Acropolis in Athens. The Corinthian column was used in the monument of Lysikrates, which is also located in Athens.

COMA, *KOH muh,* is a state of deep and complete loss of consciousness. The word comes from the Greek word *koma,* meaning *deep sleep.* Persons in this state ordinarily cannot be aroused by stimulants such as spirits of ammonia, light slapping, or a pinprick. Head injuries, tumors, and strokes may cause coma. Persons who take poisons or an overdose of sleeping drugs often develop a coma. Doctors treat coma according to its cause. For example, if it is caused by a poison, the doctor gives an antidote. LOUIS D. BOSHES

COMANCHE INDIANS, *koh MAN chee,* were a southern Plains tribe that hunted buffalo from Nebraska to northern Mexico. They won fame as the most skilled Indian horsemen of the Southwest. In battle, many Comanche eluded enemy arrows and bullets by hanging against the side of—or even under—their horses.

The Comanche lived chiefly as hunters and followed wandering buffalo herds. They hunted on foot until the 1700's, when the Spaniards brought horses to the Great Plains. Then the Comanche became master horsemen. For many years, the Comanche fiercely defended their land from other tribes and white ranchers.

In 1867, the Comanche agreed to move to a reservation in what is now southwestern Oklahoma. By 1900, whites had settled on parts of the reservation. In the early 1900's, the government gave each Comanche 160 acres (65 hectares) of land. Many of the Indians disliked farming and sold or leased their land to whites.

Today, most of the approximately 7,000 Comanche live in or near Comanche County, Oklahoma. Many of them work as accountants, bookkeepers, farmers, nurses, stockmen, or teachers. The Comanche, Apache, and Kiowa tribes jointly own about 4,500 acres (1,820 hectares) of land in and around Lawton, Okla. They have developed two industrial parks there. One park opened in 1975, and the second was scheduled for completion in 1977. MARIE C. COX

See also INDIAN, AMERICAN (Family Life [picture: A Village Scene]); QUANAH.

COMB JELLY. See CTENOPHORE.

COMBAT, TRIAL BY. See TRIAL BY COMBAT.

COMBAT ENGINEER. See ENGINEERS, CORPS OF.

COMBINATIONS. See PERMUTATIONS AND COMBINATIONS.

COMBINE is a farm machine which moves across a field, cutting and threshing in one operation such crops as small grains, soybeans, and grass seed. This combined harvester and thresher is either self-propelled or is pulled by a tractor. The combine threshes the seed from the stalks of straw, collects the seed into a tank or sacks, and leaves the straw lying on the ground. The first combine was used in Michigan in 1837, but the machine did not come into general use until about 1917. The first extensive use of the combine was on the large wheat fields of the West. Combines are now used in all parts of the United States where grain is raised.

Before the combine came into general use, most small-grain crops were harvested with *binders,* which cut and bound the straw and grain into bundles. The bundles of grain then were threshed with a stationary threshing machine. A. D. LONGHOUSE

Related Articles in WORLD BOOK include:

Kansas (picture)	Rice (picture)
Oats (picture)	Threshing Machine
Reaping Machine (picture)	Wheat (picture: A Combine)

Western Ways

Comanche Indians wear elaborate feather headdresses and bells for special ceremonial dances. The Comanche became known as the best Indian horsemen of the Southwest. Today, they work in a variety of jobs in and near Comanche County, Oklahoma.

COMBUSTION is any chemical reaction that gives off heat and light. The *rapid* union of oxygen with any substance is combustion. Combustion is usually thought of only in connection with fire, but it includes many other chemical reactions. Combustion occurs, for example, when chlorine burns in hydrogen gas, or in the burning of any substance in chlorine.

The speed of combustion determines the temperature of the burning substance. If coal burns slowly, the temperature is lower than if it burns rapidly. But the amount of heat given off by the burning of a certain amount of coal is always the same, whether combustion occurs rapidly or slowly. The kindling temperature is the lowest temperature at which a substance burns. The temperature of combustion is the highest temperature

reached during combustion. The heat of combustion, measured in calories, is the total amount of heat given off when a substance burns. See CALORIE.

Spontaneous combustion occurs when the burning substances have not been ignited by a match or some other burning object. Heaps of rags soaked with oil, or piles of coal that contain moisture, sometimes begin to burn without being ignited. In these examples, spontaneous combustion is caused by the rapid union of oxygen with carbon and hydrogen in the oil or coal. This rapid reaction raises the temperature of the rags or coal above the kindling temperature, and the substance begins to burn. RALPH G. OWENS

See also DUST EXPLOSION; FIRE; OXIDATION; OXYGEN.

COMECON. See COMMON MARKET; WORLD (map: Major Economic Organizations of the World).

COMEDY, *KAHM uh dee*, is the light and amusing branch of the drama. A comedy usually has a happy ending, unlike a *tragedy*, which usually ends in disaster. The term *comedy* also includes exaggerated forms of comic entertainment called *farce* and *burlesque*.

One of the purposes of comedy is to provide delightful entertainment for theater audiences. Another is to show people how silly they can be. All first-class comic dramatists are serious writers who hope to improve people by showing them their faults in an amusing way. Some of the greatest plays are comedies.

Comedies differ from country to country because the senses of humor of the various peoples are apt to be different. For example, French comedy is usually lighthearted and witty. Scottish comedy is *whimsical* (playful and sweet). English comedy is often clever, but gentle. German comedy may be fantastically exaggerated. Irish is satirical. American comedy is noisy and full of jokes. Comedy often depends on local situations for its appeal. For that reason, a comedy that is extremely successful in one period or place might not be considered at all funny in another. But great comedy always contains elements that are meaningful to all ages.

Comedy developed from ancient Greek festivals in honor of Dionysus (called Bacchus in Rome), the god of revelry (see DIONYSUS). In the earliest Greek comedies, a witty fellow simply indulged in ridicule. Later, a plot was added. Greek comedy reached its highest development in the plays of Aristophanes. Two Romans, Plautus and Terence, adopted plots from Greek comedies.

There have been comic playwrights in every period of history when the theater existed. William Shakespeare was the greatest writer of comedy in England in the late 1500's and early 1600's. William Congreve and William Wycherley were leading English writers of comedy during the late 1600's. Molière was the comic genius of France in the 1600's. During the 1700's, Oliver Goldsmith and Richard Brinsley Sheridan in England and Pierre de Beaumarchais in France were important authors of comedy. Modern masters of comedy include American playwrights S. N. Behrman, Moss Hart, Ben Hecht, George S. Kaufman, Neil Simon, and Thornton Wilder; British writers Sir Noel Coward, George Bernard Shaw, and Oscar Wilde; and French authors Jean Anouilh and Jean Giraudoux. GLENN HUGHES

See also BURLESQUE; DRAMA; HUMOR; TRAGEDY.

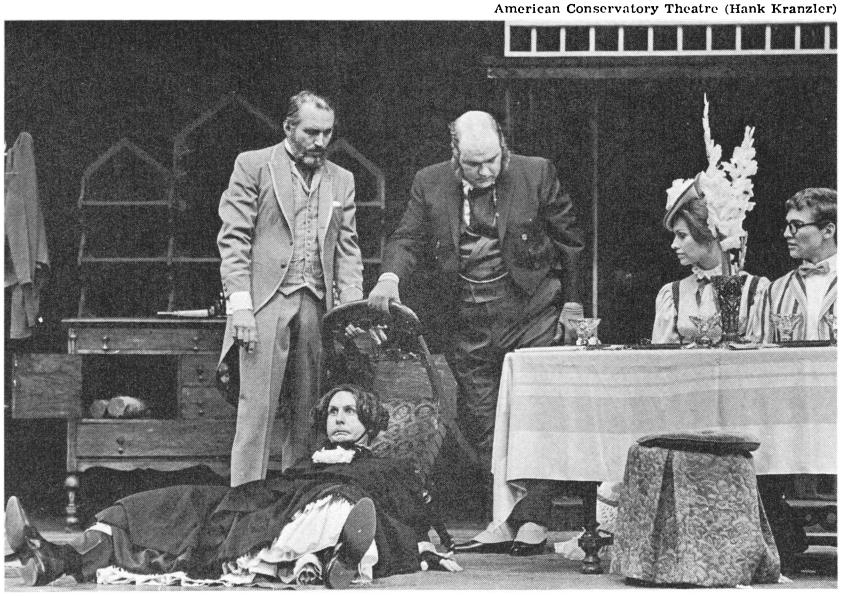
COMEDY OF ERRORS, THE. See SHAKESPEARE, WILLIAM (Shakespeare's Plays).

COMEDY OF MANNERS. See DRAMA (European Drama); ENGLISH LITERATURE (Restoration Drama).

COMENIUS, *kuh MEE nee uhs*, **JOHN AMOS** (1592-1670), was a Czech educator and bishop. His *Orbis Sensualium Pictus* (*Visible World*, 1658) was the first textbook in which pictures were as important as the text. He favored broad general education, rather than the narrow training of his day, which emphasized the study of languages. He urged the establishment of more schools and universities. Comenius was born in Moravia. CLAUDE A. EGGERTSEN

See also LITERATURE FOR CHILDREN (The First Children's Books).

American Conservatory Theatre (Hank Kranzler)



Comedy Called *Farce* deals in an exaggerated way with ridiculous situations. *Charley's Aunt*, written by Brandon Thomas, is a classic English farce first presented in 1892. The scene at the left shows some of the confusion that develops when a young man masquerades as his friend's aunt.

COMET, *KAHM iht*, is an object that resembles a fuzzy star and travels along a definite path through the solar system. Some of the brightest comets develop a long, shining tail when they come near the sun. The tail of a comet may stream across space as far as 100 million miles (160 million kilometers). A comet has a distinct center called a *nucleus* that measures less than 10 miles (16 kilometers) in diameter. A hazy cloud called a *coma* surrounds the nucleus. Its diameter may be as large as 1 million miles (1.6 million kilometers). The coma and nucleus make up the comet's head.

Most comets cannot be seen without a telescope. Some are visible to the unaided eye, but only for several weeks or months when they pass closest to the sun. Halley's Comet is probably the best known comet. It last came within view from the earth in 1910, when its brightness and enormously long tail provided a spectacular sight. This comet was named for the English astronomer Edmund Halley, who recognized that it could be seen every 77 years as it orbited the sun.

A number of other extremely bright comets have been seen since 1910. For example, Comet Arend-Roland and Comet Mrkos appeared in 1957 and Comet Ikeya-Seki in 1965. In 1973, Comet Kohoutek became the first comet to be studied by men in space. Astronauts in the Skylab space station photographed it and so provided much new information about comets.

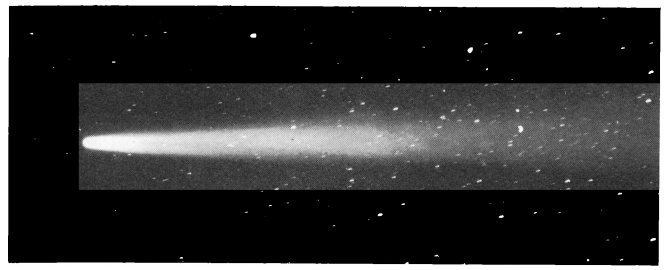
For centuries, many people believed the coming of a comet would bring a disaster, such as a war or an epidemic. Halley's Comet revived these fears in 1910, but the earth passed through the comet's tail with no apparent harm. However, a collision between the earth and a comet's head could be very destructive.

The Composition of Comets. Scientists once believed the nucleus of a comet consisted of tiny solid particles held together loosely by gravitation. Today, most astronomers think the nucleus resembles a dirty snowball that was formed in the cold, distant regions of the solar system. The nucleus probably consists of frozen gases and frozen water mixed with dust particles. The gases include ammonia, carbon dioxide, carbon monoxide, and methane. The gases and water make up from 70 to 80 per cent of the mass of a comet. The remaining 20 to 30 per cent may resemble meteoric particles. This portion consists of fine grains and larger chunks of metals and rocky material.

FAMOUS COMETS

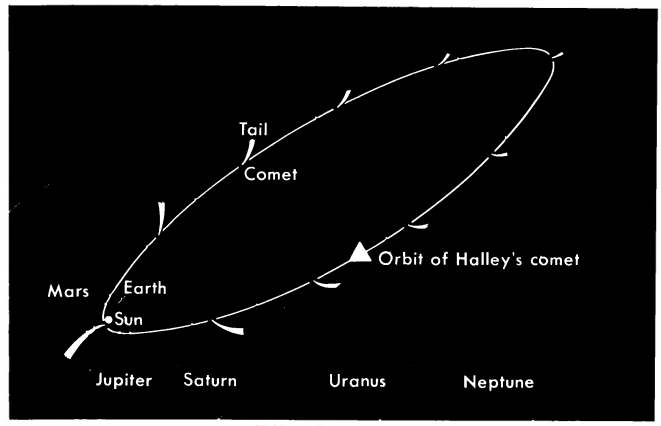
Name	First Seen	Period of Orbit (Years)
Halley's Comet	Before 86 B.C.	76-79*
Tycho Brahe's Comet	1577	Unknown
Biela's Comet	1772	6.6-6.8*
Encke's Comet	1786	3.3
Comet Flaugergues	1811	3,000
Comet Pons-Winnecke	1819	5.6-6.3*
Great Comet of 1843	1843	513
Donati's Comet	1858	2,000
Great Comet of 1882	1882	760
Comet Morehouse	1908	Unknown
Comet Schwassmann-Wachmann 1	1927	16.1-16.4*
Comet Humason	1961	2,900
Comet Ikeya-Seki	1965	880
Comet Tago-Sato-Kosaka	1969	420,000
Comet Bennett	1969	1,680
Comet Kohoutek	1973	75,000

*Period changes



Hale Observatories

Halley's Comet, *above,* **appears about every 77 years. It was last seen in 1910 and is expected to reappear about 1986.**



WORLD BOOK diagram by Mas Nakagawa

A Comet Travels Through the Solar System along an egg-shaped orbit called an *ellipse*. The orbit of Halley's comet, shown in the diagram above, crosses the orbits of the earth and other planets. The tail of a comet always points away from the sun.

As a comet approaches the sun, the heat causes the outer layers of the icy nucleus to evaporate. The evaporation releases dust and gases, which form the coma around the nucleus. The pressure of the sun's light may push the smallest dust particles and gas molecules away from the coma, forming one or more tails. This pressure makes a comet's tail point away from the sun. When a comet approaches the sun, its tail brings up the rear. But when the comet moves away from the sun, its tail leads.

All of a comet's light comes from the sun. The brightness of a comet results partly from sunlight reflected by its nucleus and coma. In addition, when a comet is closest to the sun, gas molecules in the coma release energy absorbed from the sun's rays.

The Paths of Comets. Most comets travel around the sun in *elliptical* (oval-shaped) paths. The time it takes a comet to make a complete orbit is called its *period*. Some comets have short periods of less than seven years. Others travel in such huge orbits that they pass near the sun only once in thousands or even millions of years. No comet seems to have approached the sun from beyond the limits of the solar system. Therefore, all comets seen by astronomers are considered part of the solar system.

ELIZABETH ROEMER

See also BRAHE, TYCHO; HALLEY'S COMET; MOON (The Moon's Surface).

COMIC OPERA. See OPERA (Baroque Opera).

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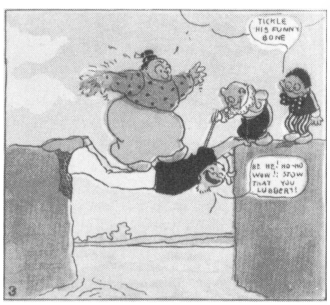
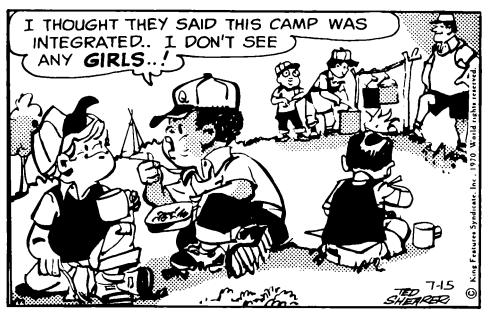
Adventure Comics, such as "Tarzan," *above,* tell stories of action, suspense, and violence. This early example shows how the artist, Burne Hogarth, organized the text and pictures so that readers could easily follow the story. Adventure comics first became popular during the 1930's.



Panel drawn about 1903; National Newspaper Archive and Academy of Comic Art

"The Katzenjammer Kids," *left,* is the oldest comic strip still published. Rudolph Dirks, its creator, was one of the first cartoonists to put a character's words in areas called *balloons.*

Integrated Comics became a regular feature in many newspapers, starting in the 1960's. Some comics, such as Ted Shearer's "Quincy," *right,* deal humorously with relations between Negroes and whites.



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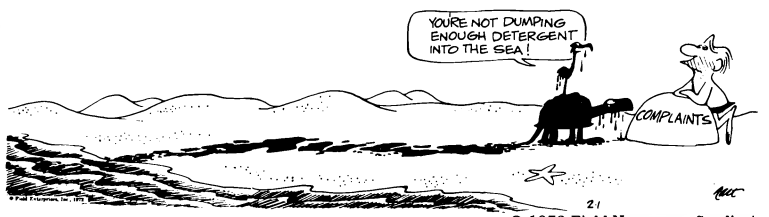

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Dramatic Comics tell about events in the daily lives of ordinary people. "Mary Worth," *left,* drawn by Ken Ernst and Allen Saunders, features romantic stories.

Satiric Comics poke fun at serious social problems. In the "B. C." panel shown above, the artist, Johnny Hart, makes a humorous comment about water pollution.

COMICS are a series of related cartoons that tell a story. Most comic strips appear in newspapers. A comic may tell part of a continuing story, or it may be a complete story in itself. Some comics are published in magazine form as *comic books.* All comics feature a continuing cast of characters. In most comics, conversation between the characters appears near their heads in white areas called *balloons.* A few comics have no conversation at all.

The main purpose of comics is entertainment. Most early comics used humor and became known as *funnies.* Today, many comics are based on humor, but others tell exciting adventure stories. Still other comics describe dramatic events in the daily lives of such people as doctors, reporters, and secretaries. Some comics retell Bible stories, historical tales, or legends.

Surveys show that comic strips are the most popular feature in newspapers. Some strips, such as Milton Caniff's "Steve Canyon" and Charles Schulz's "Peanuts," appear in more than 600 newspapers in the United States and other countries. Among major U.S. newspapers, only *The New York Times* and *The Wall Street Journal* do not have comics. About 250 million comic books are also sold annually throughout the world.

The popularity of comics has made them a useful tool in advertising. Many companies use comics or characters from famous comics to promote their products. Comics are also used in various educational publications.

Comics have inspired books, motion pictures, plays, songs, and radio and television programs. They have popularized such expressions as "heebie-jeebies" and

"Good Grief!" Comics have even influenced a movement in the fine arts called pop art.

How Comics Are Created. Most comic strips are the work of one person who does both the drawing and writing. In some cases, two persons work together on a strip. A writer works out the story, and a cartoonist draws the *panels* (individual pictures). Comic books require a great amount of material, and many artists and writers may work to produce one.

A cartoonist separates the events of a story so he can draw them in individual panels. He must make sure that the action moves smoothly from one panel to the next, and from one installment to the next.

The cartoonist finishes his comic strip about six weeks before it appears in print. Most cartoonists have a distributing company called a *syndicate* that acts as their business agent. The cartoonist sends the strip to the syndicate, and the syndicate then distributes it to newspapers in all parts of the world. See NEWSPAPER SYNDICATE.

History. The first comic strip to become widely popular, "Hogan's Alley," appeared in 1895. Richard F. Outcault drew it for the Sunday edition of the *New York World.* The strip starred a mischievous little creature who became known as the *Yellow Kid* (see OUTCAULT, RICHARD FELTON). Soon, other newspapers also began to feature comic strips in order to attract more readers. In 1897, Rudolph Dirks started "The Katzenjammer Kids" for the *New York Journal.* The first successful daily comic strip, Bud Fisher's "Mutt and Jeff," began in 1907 in the *San Francisco Chronicle.*

During the 1930's, adventure strips became popular. Chester Gould created the detective strip "Dick Tracy" in 1931. Such adventure strips as "Superman," "Tarzan," and "Terry and the Pirates" first became popular during this period.

Harold Gray's "Little Orphan Annie," which started in 1924, was one of the first strips to mix entertainment with the artist's political views. Today, several other strips, including Al Capp's "Li'l Abner" and Walt Kelly's "Pogo," contain humorous comments about political and social events.

The first comic book, a collection of reprinted "Mutt and Jeff" strips, appeared in 1911. Other early comic books also consisted of reprinted newspaper strips. The first comic books made up of original material were published in 1935.

Comics lost some of their popularity after television became widespread in the late 1940's. Comic books especially suffered because a few publishers printed ones that contained obscenities and violence. In 1954, almost all U.S. comic book publishers adopted the Comics Code Authority, which prohibited such material.

By the 1960's, comics had regained some of their popularity. They once appealed mostly to children and uneducated adults. But today, such strips as "Peanuts," "Pogo," and Mort Walker's "Beetle Bailey" can be enjoyed by both children and adults, and by the educated as well as the uneducated. These comics are simple and funny, but also sophisticated. ROY PAUL NELSON

See also CAPP, AL; SCHULZ, CHARLES MONROE; CARICATURE; CARTOON.

COMINFORM, short for **Com**munist **Inform**ation Bureau, was established in 1947. Its chief purpose was to spread Communist propaganda. The Cominform's main publication was its newspaper, *For a Lasting Peace, for a Peoples' Democracy.* Out of the Cominform developed the Warsaw Pact. This was the Communists' answer to the North Atlantic Treaty Organization (NATO), established by non-Communist countries in 1949. The Cominform was dissolved in 1956. WILLIAM B. BALLIS

COMINTERN, short for **Com**munist **Intern**ational, often called the *Third International,* was founded in 1919. V. I. Lenin established it to organize revolutions through Communist parties in every country. Communist groups from various countries sent delegates to congresses in Moscow. The Russians dissolved the Comintern in 1943. See also COMMUNISM (The Comintern); INTERNATIONAL, THE. WILLIAM B. BALLIS

COMITIA, *koh MIHSH ih uh,* were assemblies of the people of ancient Rome. The oldest assembly, the *Comitia Curiata,* confirmed the selection of kings and approved important decisions. Both the *Comitia Centuriata* and the *Comitia Tributa* elected officials, voted on issues, and made laws. The Comitia Centuriata, organized according to wealth, dealt with the more important issues and officials. The Comitia Tributa, organized according to tribes, became the most important lawmaking body. FRANK C. BOURNE

COMMA (,) is a mark of punctuation. Its chief uses include: (1) separating the parts of a compound sentence joined together with *and, but, or, nor, for, so,* or *yet;* (2) setting off a phrase or clause preceding a subject —*After leaving, he felt sad;* (3) setting off a nonrestrictive modifier or a phrase in apposition—*Bob, who was next, had no trouble. Jim, the boss, spoke last;* (4) separating each item in a series—*to strive, to seek, to find;* and (5) separating the parts of a date, the parts of an address, or the parts of a name. SUMNER IVES

See also PUNCTUATION (The Comma).

COMMAGER, HENRY STEELE (1902-), an American educator and historian, won high praise for his books, *The Growth of the American Republic* (with Samuel E. Morison, 1931), and *America: the Story of a Free People* (with Allan Nevins, 1942). Commager and Nevins also wrote *The Heritage of America* (1939). Commager edited *Documents of American History* (1934), and wrote frequently for periodicals on public issues. He was born in Pittsburgh, Pa., and was graduated from the University of Chicago. He became a professor of history at Amherst College in 1956. MERLE CURTI

The Bobbs-Merrill Co., Inc.

Henry Steele Commager

COMMAND. See AIR FORCE, UNITED STATES (Organization); ARMY, UNITED STATES (Organization of the Army); NAVY, UNITED STATES (Organization of the Navy).

COMMANDER. See RANK IN ARMED SERVICES.

COMMANDER IN CHIEF has supreme command of a nation's armed services. In the United States, the President is the commander in chief of the Army, Navy, and Air Force. The title of *commander in chief* may also be given to an officer commanding a theater of operations, a major naval fleet, a unified command of units from two or more of the military services, or a specified command assigned to a specific task. THOMAS E. GRIESS

See also PRESIDENT OF THE UNITED STATES.

COMMANDER ISLANDS, or KOMANDORSKIYE ISLANDS, are a Russian group in the Bering Sea, east of the Kamchatka Peninsula. They cover about 715 square miles (1,852 square kilometers), and consist of Bering and Medny islands and two islets. The islands are mountainous, and largely covered with tundra vegetation (see TUNDRA). The people fish, and operate fox and seal fur farms. See also BERING SEA. THEODORE SHABAD

COMMANDMENTS, TEN. See TEN COMMANDMENTS.

COMMANDO is the British term for a soldier who is trained to take part in surprise attacks. Such soldiers were called *Rangers* in the U.S. Army during World War II. Today, U.S. soldiers who qualify for difficult commandolike training can become members of the Army *Special Forces*. The U.S. Air Force has similar *Special Operations* units (formerly *Air Commandos*).

The word *commando*, originally Portuguese, was first used in South Africa during the Boer War to describe surprise actions. Prime Minister Winston Churchill suggested the name for the British *combined operations units* that staged hit-and-run raids during World War II. Commando raids destroyed war plants and materials, rescued Allied agents, or tried out invasion tactics.

Famous commando operations during World War II included a raid on St. Nazaire, France, in March, 1942. Commandos destroyed the largest dock in western Europe, preventing the Germans from using it for the battleship *Tirpitz*. Canadian and British commandos staged the largest raid, on Dieppe, France, on Aug. 19, 1942. They fought for nine hours, but suffered heavy losses. Units of U.S. Special Forces and Special Operations were used in Vietnam in the 1960's. CHARLES B. MACDONALD

See also ARMY, UNITED STATES (Special Forces); RANGERS; WINGATE'S RAIDERS.

COMMEDIA DELL' ARTE. See DRAMA (Italian Renaissance Drama; picture).

COMMEMORATIVE COIN. See MONEY (U.S. Money Today).

COMMENCEMENT. See GRADUATION.

COMMENSALISM. See SYMBIOSIS.

COMMENTATOR. A radio or television speaker who comments on sports, politics, and general news is called a *commentator*. News broadcasters report the news; commentators try to interpret it. EARL F. ENGLISH

See also JOURNALISM (In Radio and Television).

COMMERCE, *KAHM urs*, is the buying and selling of merchandise. It usually refers to large-scale transactions, particularly between different places or communities. In the United States, matters of commerce are supervised by the Department of Commerce and by state commerce commissions. For more information, see TRADE and BUSINESS with their Related Articles.

COMMERCE, CHAMBER OF. See CHAMBER OF COMMERCE; CHAMBER OF COMMERCE OF THE UNITED STATES.

COMMERCE, DEPARTMENT OF, is an executive department of the United States government. The department's chief responsibility is to promote the nation's economic development and technological advancement. It helps the President form national economic policy and provides economic data, studies, and advice to other federal agencies and to private enterprise. The secretary of commerce, a member of the President's Cabinet, heads the department.

Functions. The Department of Commerce collects, analyzes, and distributes commercial statistics. It conducts population and agricultural censuses and coastal and geodetic surveys. It compiles and publishes nautical and aeronautical charts. It establishes weights, measures, and standards for commodities. The department issues patents, registers trademarks, and provides weather forecasts. It also assists the maritime industry and promotes travel to the United States by people of other countries.

Organization. The secretary of commerce is appointed by the President with the approval of the Senate. He administers all functions assigned to the department and advises the President on matters that affect the nation's industry and commerce. He serves as the President's chief contact with the business world.

The undersecretary of commerce is the secretary's chief assistant. He serves as acting secretary in the secretary's absence. There are also seven assistant secretaries of commerce.

The assistant secretary for science and technology supervises the Patent Office, the National Bureau of Standards, the Office of Telecommunications, and the National Technical Information Service. The assistant secretary for domestic and international business directs the Domestic and International Business Administration (DIBA). The DIBA works to promote American

SECRETARIES OF COMMERCE

Name	Year Appointed	Under President
George B. Cortelyou	1903	T. Roosevelt
Victor H. Metcalf	1904	T. Roosevelt
Oscar S. Straus	1906	T. Roosevelt
Charles Nagel	1909	Taft
William C. Redfield	1913	Wilson
Joshua W. Alexander	1919	Wilson
*Herbert C. Hoover	1921	Harding, Coolidge
William F. Whiting	1928	Coolidge
Robert P. Lamont	1929	Hoover
Roy D. Chapin	1932	Hoover
Daniel C. Roper	1933	F. D. Roosevelt
*Harry L. Hopkins	1938	F. D. Roosevelt
Jesse H. Jones	1940	F. D. Roosevelt
*Henry A. Wallace	1945	F. D. Roosevelt, Truman
*W. Averell Harriman	1946	Truman
Charles Sawyer	1948	Truman
*Sinclair Weeks	1953	Eisenhower
Frederick H. Mueller	1959	Eisenhower
Luther H. Hodges	1961	Kennedy, L. B. Johnson
John T. Connor	1965	L. B. Johnson
Alexander B. Trowbridge	1967	L. B. Johnson
Cyrus R. Smith	1968	L. B. Johnson
Maurice H. Stans	1969	Nixon
Peter G. Peterson	1972	Nixon
Frederick B. Dent	1973	Nixon, Ford
Rogers C. B. Morton	1975	Ford

*Has a separate biography in WORLD BOOK.

Department of Commerce

The Department of Commerce encourages United States domestic and foreign trade. The departmental seal, *above*, was adopted in 1913. It appears on the cornerstone of the Department of Commerce Building, *left*, which stands on 14th Street in Washington, D.C.

THE PRESIDENT

SECRETARY

- General Counsel
- Assistant Secretary for Administration
- Office of Policy Development
- Office of Communications
- Office of Regional Economic Coordination

- Office of Congressional Relations
- Office of Minority Business Enterprise

UNDERSECRETARY

Administrator
- National Oceanic and Atmospheric Administration

Administrator
- National Fire Prevention and Control Administration

Assistant Secretary for Domestic and International Business
- Bureau of International Commerce
- Bureau of Resources and Trade Assistance
- International Economic Policy and Research
- Ombudsman for Business
- Bureau of Domestic Commerce
- Bureau of East-West Trade
- Office of Field Operations

Assistant Secretary for Science and Technology
- Patent Office
- National Bureau of Standards
- Office of Telecommunications
- National Technical Information Service

Assistant Secretary for Economic Affairs
- Social and Economic Statistics Administration
- Bureau of the Census
- Bureau of Economic Analysis

Assistant Secretary for Maritime Affairs
- Maritime Administration

Assistant Secretary for Economic Development
- Economic Development Administration

Assistant Secretary for Tourism
- United States Travel Service

business growth and progressive business policies and to strengthen the international economic position of the United States. The DIBA operates through four bureaus, more than 40 field offices in the United States and Puerto Rico, and many trade promotion offices abroad. It also includes the Ombudsman for Business, which answers questions about government programs that affect business.

The assistant secretary for economic affairs coordinates economic research and statistical programs that are carried out through the Social and Economic Statistics Administration. The assistant secretary for economic development directs the Economic Development Administration, which promotes programs to create jobs and increase incomes in economically weak areas of the United States.

The assistant secretary for maritime affairs heads the Maritime Administration, which promotes and assists the American merchant marine. The assistant secretary for tourism heads the United States Travel Service, which encourages residents of other countries to visit the United States. There is also an assistant secretary for administration.

The administrator of the National Oceanic and Atmospheric Administration coordinates the work of all federal agencies involved in conservation, development, educational activities, exploration, monitoring, and research relating to the oceans and the atmosphere.

The administrator of the National Fire Prevention and Control Administration supervises efforts to prevent and control fires. For example, the agency conducts programs to improve the training of fire fighters and to educate the public about fire prevention. The Office of Minority Business Enterprise coordinates programs to help members of minority groups become owners and managers of companies.

History. Congress established the Department of Commerce and Labor on Feb. 14, 1903, at the request of President Theodore Roosevelt. The department included eight bureaus that handled matters concerning the census, corporations, fisheries, immigration, labor, navigation, standards, and statistics. On March 4, 1913, Congress set up a separate Department of Labor and a new Department of Commerce.

Since 1913, many bureaus and agencies have been transferred to or from the department. In 1925, for example, Congress switched the Patent Office from the Department of the Interior to the Department of Commerce. In 1940, the U.S. Weather Bureau, which had been under the Department of Agriculture, became part of the Department of Commerce. In 1966, Congress transferred several agencies from the Department of Commerce to the newly formed Department of Transportation. The Department of Commerce has about 33,000 employees.

Critically reviewed by the DEPARTMENT OF COMMERCE

Related Articles in WORLD BOOK include:

Census, Bureau of the
Flag (color picture: Flags of the United States Government)
Maritime Administration
Merchant Marine
National Bureau of Standards
National Ocean Survey
National Oceanic and Atmospheric Administration
Patent Office
Weather Service, National

COMMERCIAL. See ADVERTISING (Television; Radio; Preparing Advertisements).

COMMERCIAL ART includes many types of art used for business purposes. It is often called *advertising art*, because much commercial art is used in selling products and services. Commercial art is different from *fine*, or *original art*, such as painting and sculpture, because it must be reproduced by printing or other methods.

Commercial artists work for advertising agencies, department stores, manufacturers, motion-picture studios, publishers, television stations, and many other types of businesses. They create art for such things as advertisements, books, magazines, packages, filmstrips, and trademarks. The art work in WORLD BOOK is produced by commercial artists. Commercial art studios offer a variety of art services, and range in size from only a few to more than 100 employees. Some artists work independently, and are paid according to each assignment. They are called *free-lance artists*. About 50,000 persons work in some phases of commercial art in the United States.

The early commercial artists were self-taught or had some training in fine art. These artists worked on design, drawing, lettering, and all steps in preparing a piece of art work for reproduction. Educational training aimed at providing specialized courses in commercial art was not developed until about 1930.

In recent years the field has expanded and developed greatly. Today, many commercial artists specialize in such specific parts of commercial art as design, illustration, photography, and photo retouching. Specialists within these areas include fashion illustrators, product illustrators, book illustrators, technical illustrators, cartoonists, and film animators.

Some commercial artists become art directors. Art directors do little art work themselves, but they plan and direct the work of others. Many commercial artists specialize in one field of commercial art, such as the design of advertisements.

Commercial art is a relatively new profession. Few people were employed in the field before 1900, and educational training for a professional career in commercial art was not available until about 1930. Today, there are many commercial art schools that offer four-year training programs, and many colleges and universities offer degrees in commercial art. RICHARD S. COYNE

Related Articles in WORLD BOOK include:

Advertising
Cartoon
Design
Electrotyping
Engraving
Etching
Illustration
Lettering
Lithography
Mechanical Drawing
Packaging
Photoengraving and Photolithography
Photography
Poster

COMMERCIAL ATTACHÉ. See ATTACHÉ.

COMMERCIAL EDUCATION. See BUSINESS EDUCATION.

COMMERCIAL LAW. See BUSINESS LAW.

COMMISSAR is a Communist title for a Russian official. V. I. Lenin, Joseph Stalin, and Leon Trotsky were *people's commissars*, the most important group. In 1918 commissars were appointed to watch over officers and troops so that they acted according to Communist Party wishes. Political instructors succeeded army commissars in 1942, and *ministers* replaced people's commissars in 1946. WILLIAM B. BALLIS

COMMISSION is the fee earned by an agent who performs a service or does business for someone else. The

amount is usually a percentage of the amount of the business. The percentage is agreed upon beforehand.

COMMISSION, MILITARY, is a written order giving an officer rank in the armed services. In the United States, the President commissions officers with the approval of the Senate. An officer accepts the commission voluntarily, and it does not have to be renewed. In wartime, the President may remove an officer from the commissioned list for cause. A board of officers handles dismissals. The term *in commission,* when referring to a ship or an aircraft, means that the vessel or airplane is ready for active service. THOMAS E. GRIESS

COMMISSION FORM OF GOVERNMENT. See CITY GOVERNMENT.

COMMISSION OF FINE ARTS. See FINE ARTS, COMMISSION OF.

COMMISSION ON CIVIL RIGHTS. See CIVIL RIGHTS, COMMISSION ON.

COMMISSION ON OBSCENITY AND PORNOGRAPHY. See OBSCENITY AND PORNOGRAPHY.

COMMISSION ON THE STATUS OF WOMEN. See WOMAN (Woman's Roles Today).

COMMISSIONER OF EDUCATION. See EDUCATION, OFFICE OF.

COMMITTEE FOR ECONOMIC DEVELOPMENT (CED) is a private organization that makes recommendations on ways to improve the United States economy. CED is a nonprofit, nonpolitical, and nonpartisan organization. Its suggestions are chiefly aimed at achieving full employment, higher living standards, and a more stable economy. It is made up of 200 trustees who are business and educational leaders. The committee makes its recommendations through a series of publications called *Statements on National Policy.* It also publishes papers by outstanding scholars on economic problems. CED was created in 1942. It has offices in New York City and Washington, D.C.

Critically reviewed by the COMMITTEE FOR ECONOMIC DEVELOPMENT

COMMITTEE FOR INDUSTRIAL ORGANIZATION. See CONGRESS OF INDUSTRIAL ORGANIZATIONS.

COMMITTEE OF PUBLIC SAFETY. See FRENCH REVOLUTION (The Convention).

COMMITTEE OF THE WHOLE is a committee composed of all the members of an organization. Usually a large group will ask a small committee to investigate a matter and make a report to the whole group. But sometimes the whole group wants to consider the matter, and meets as a committee of the whole. The advantage of meeting in this manner, or as a committee of the whole, is that the discussion can be informal, because no official action can be taken.

After its discussion, the committee of the whole ends the meeting by *rising from the committee.* The group then returns to its regular rules and ways. The chairman gives an official report of any decisions to the group.

The committee of the whole is a device often used by legislative bodies. Any member of either branch of the United States Congress can act as chairman of a committee of the whole.

In the Canadian House of Commons, the chairman of the committee of the whole is the deputy speaker. In the British House of Commons, a regular chairman other than the speaker is chosen. THOMAS A. COWAN

COMMITTEE ON SPACE RESEARCH. See SPACE TRAVEL (Steps in the Conquest of Space).

COMMITTEES OF CORRESPONDENCE were organized by towns, counties, and colonies before and during the Revolutionary War in America. The first Committee of Correspondence was appointed by the town of Boston in 1772 at the suggestion of Samuel Adams. The committee's purpose was to keep in touch with other New England districts in their struggle to uphold the rights of the colonists. The first colonial committee was appointed by Virginia in 1773. The committees played an important part in drawing the colonists together in preparation for their struggle with Great Britain. See also COMMITTEES OF SAFETY. JOHN R. ALDEN

COMMITTEES OF SAFETY sprang up in the colonies to carry on necessary functions of government during the Revolutionary War in America. They provided the transitional government after colonial governors had been overthrown and before the colonies could set up their first state governments. In Connecticut and New Hampshire, the committees continued their work even after the state governments had begun operating.

On July 18, 1775, the Second Continental Congress urged the colonies to set up committees of safety. The new committees took over much of the work of the earlier committees of correspondence, which had carried on vigorous programs of propaganda against the British since 1772. See COMMITTEES OF CORRESPONDENCE.

COMMODITY CREDIT CORPORATION (CCC) is a corporation within the U.S. Department of Agriculture. It is wholly owned by the U.S. government. The CCC is managed by a board of directors, subject to the general supervision and direction of the Secretary of Agriculture. The corporation has capital stock of $100 million held by the United States, and is authorized to borrow up to $14\frac{1}{2}$ billion.

The CCC conducts many programs designed to support and protect farm income and prices, assist in the maintenance of balanced and adequate supplies of agricultural commodities, and assist in their orderly distribution. For these purposes, the CCC conducts price support, export, and storage programs. In carrying out these programs, it engages in buying, selling, lending, and other activities. It makes available the materials and facilities needed for the production and marketing of agricultural commodities. The CCC also obtains agricultural commodities for sale to other government agencies, foreign governments, and relief agencies, and to meet domestic requirements.

In carrying out its operations, the CCC uses the facilities and personnel of various agencies of the Department of Agriculture. The CCC was created in 1933.

COMMODITY EXCHANGE. See BOARD OF TRADE.

COMMODITY STABILIZATION SERVICE. See AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE.

COMMODORE. See RANK IN ARMED SERVICES (table).

COMMON CARRIER is a person or company that transports passengers and goods by water, land, or air, for a fee. The term includes truck lines, express companies, bus lines, street railways, railroads, steamboat companies, air transport, and pipelines. Telephone and telegraph companies are also included, although they do not transport goods. Stores with a delivery service solely for their customers are not common carriers.

The common law has placed the carrier under two

great obligations. First, its service is compulsory, for it must serve anyone who can pay. Second, it is liable for loss or injury to goods or passengers carried. These obligations are regulated by law. In the United States, trade between states is under federal control. States control common carrier operations within their borders.

It is generally stated that common carriers are responsible for any loss or accident except those due to an "act of God or of the public enemy." In this sense, an "act of God" means any unavoidable accident that occurs through no fault of a human being. A train being struck by lightning is an example of an "act of God." The term *public enemy* includes any government that is at war with the government of the common carrier. Robbers, bandits, and rebels are not regarded as public enemies in this sense.

Passenger carriers ordinarily are required to accept as passengers any persons who offer to pay the required fare. But they need not carry drunken or disorderly persons, anybody with a contagious disease, fugitives from justice, or those who take passage for the purpose of committing crime. FRANKLIN M. RECK

See also FEDERAL COMMUNICATIONS COMMISSION; INTERSTATE COMMERCE COMMISSION.

COMMON CAUSE is a citizens' organization that works for political and social reform in the United States. The group calls for reform of congressional procedures and campaign financing. It helped bring about U.S. withdrawal from the Vietnam War in 1973. The organization also backed the successful effort to give 18-year-olds the right to vote in national elections. Common Cause supports no political party.

The organization maintains that none of the nation's major problems can be solved unless the government becomes more responsive to the people's needs and desires. To help make the government more responsive, Common Cause works to abolish the seniority system in the selection of the chairmen of congressional committees (see CONGRESS OF THE UNITED STATES [The Committee System]). The group demands that congressional committees make their bill-writing sessions public. Common Cause also calls for limits on campaign spending and on private contributions to candidates. It supports the use of public funds to pay campaign expenses.

Common Cause was founded in 1970 by John W. Gardner, secretary of health, education, and welfare from 1965 to 1968. The organization has more than 323,000 members. Its headquarters are at 2030 M Street NW, Washington, D.C. 20037. HOWARD H. QUINT

COMMON LAW is a body of rulings made by judges on the basis of community customs and previous court decisions. It forms an essential part of the legal system of many English-speaking countries, including the United States and Canada. Common law covers such matters as contracts, ownership of property, and the payment of claims for personal injury.

Early in England's history, judges decided cases according to the way they interpreted the beliefs and unwritten laws of the community. If another judge had ruled in an earlier, similar case, that judge's decision was often used as a *precedent* (guide). After many judges decided the same question in a similar way, the ruling became law.

Common law is often contrasted with *civil law*, a body of rules passed by a legislature. Under civil law, a judge decides a case by following written rules, rather than previous court decisions.

Common law differs from *equity*, a set of standards developed to allow greater flexibility in court decisions. During the late Middle Ages, England created courts of equity to decide cases that courts of common law might treat too strictly. The king's chancellor presided over the courts of equity. These courts decided cases by broad principles of justice and reason, rather than by the rigid standards of common law.

The legal system of the United States has developed from English common law and equity. Only one state, Louisiana, modeled its legal system on civil law. Louisiana used the civil law of France, called the *Code Napoléon*. During the late 1800's, many states combined their courts of common law and courts of equity. One group of judges administers the combined courts. In Canada, similarly, only the province of Quebec based its legal system on French law. MORTON J. HORWITZ

See also CIVIL LAW; EQUITY; LAW (Sources); STATUTE.

COMMON-LAW MARRIAGE. See MARRIAGE (Other Restrictions).

COMMON MARKET is an economic union of nations. Nations form common markets to stimulate industrial growth, increase employment, and put more goods and services within the consumer's reach. Common markets stimulate trade among members by eliminating tariffs and other trade barriers within the organization.

For information on how a common market operates, see EUROPEAN COMMUNITY.

Common markets and the countries that have full membership in them include:

Arab Common Market. Founded: 1964. Members: Egypt, Iraq, Kuwait, Jordan, and Syria.

Council for Mutual Economic Assistance (COMECON). Founded: 1949. Members: Albania, Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, Mongolia, Poland, Romania, and Russia.

East African Community. Founded: 1967. Members: Kenya, Tanzania, Uganda.

European Economic Community (EEC), also called the *European Common Market.* Founded: 1957. Members: Belgium, Denmark, France, West Germany, Great Britain, Ireland, Italy, Luxembourg, and The Netherlands. See EUROPEAN COMMUNITY.

European Free Trade Association (EFTA). Founded: 1959. Members: Austria, Iceland, Norway, Portugal, Sweden, and Switzerland. See EUROPEAN FREE TRADE ASSOCIATION.

General Treaty for Central American Economic Integration. Founded: 1960. Members: Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua.

Latin-American Free Trade Association (LAFTA). Founded: 1960. Members: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay, and Venezuela.

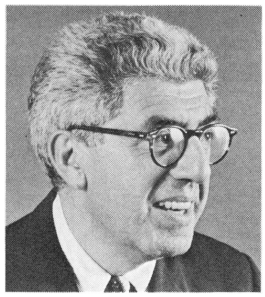
COMMON PLEAS, COURT OF. See COURT OF COMMON PLEAS.

COMMON RATIO. See PROGRESSION; SERIES (Working with Infinite Series).

COMMON SENSE. See PAINE, THOMAS.

COMMON STOCK. See STOCK, CAPITAL.

COMMONER, BARRY (1917-), is an American biologist and educator. Since the early 1950's, he has warned the public of the dangerous effects of modern technology on the environment. Commoner has expressed concern over the widespread use of chemical fertilizers, detergents, nuclear power, pesticides, and other developments of modern technology without concern for their effect on the balance of nature.



WORLD BOOK photo

Barry Commoner

Commoner has worked to make biology a useful tool in the solution of various human problems. He has urged other scientists to make their special knowledge available to the public with that same goal.

Commoner was born in New York City and graduated from Columbia University in 1937. He received a Ph.D. from Harvard University in 1941. Commoner joined the faculty of Washington University in 1947. His books include *Science and Survival* (1966) and *The Closing Circle* (1971). SHELDON NOVICK

COMMONS, HOUSE OF. See HOUSE OF COMMONS.

COMMONS, JOHN ROGERS (1862-1945), pioneered in the development of many applied fields of economics. He worked especially in labor economics and labor history, and in the promotion of progressive social legislation. His writings include *Institutional Economics* (1934) and *Legal Foundations of Capitalism* (1924). He was born in Hollandsburg, Ohio. H. W. SPIEGEL

COMMONWEALTH is a term sometimes used for a state, a country, or a group of states and countries. It originally meant a group of persons banded together for the common good or public welfare. The United States may be called a commonwealth. Pennsylvania, Massachusetts, Virginia, and Kentucky use the word *commonwealth* as part of their official titles. Puerto Rico is a commonwealth of the United States.

Australia is made up of several states. Its official name is The Commonwealth of Australia. The Commonwealth of Nations includes such countries as Great Britain, Canada, Australia, and New Zealand.

See also AUSTRALIA; COMMONWEALTH OF NATIONS; ENGLAND, COMMONWEALTH OF; PUERTO RICO.

COMMONWEALTH DAY. See VICTORIA DAY.

COMMONWEALTH FUND is a charitable foundation established in 1918 to promote the welfare of mankind. At present, the foundation gives most of its income to the promotion of health, chiefly through aid to medical education. It also sponsors the Harkness Fellowships, annual awards which permit young university graduates from Great Britain, Western European countries, Australia, and New Zealand to study in the United States.

The Commonwealth Fund makes grants from income totaling about $5 million a year. The fund was established by a gift from Mrs. Stephen V. Harkness. Her son, Edward S. Harkness, served as president of the fund from 1918 until his death in 1940. Headquarters are at 1 East 75th Street, New York, N.Y. 10021. For the assets of the fund, see FOUNDATIONS (table).

Critically reviewed by the COMMONWEALTH FUND

COMMONWEALTH OF NATIONS

COMMONWEALTH OF NATIONS is an association of independent countries and their dependencies that have lived under British law and government. The association includes Great Britain and about 30 nations that were once British colonies. Britain and a few other member nations have about 30 territories that are considered part of the Commonwealth. The Commonwealth nations and their territories cover about a fourth of the earth's land surface and have about a fourth of the world's population.

The Commonwealth countries have a tradition of mutual cooperation that stems from their common history. The Commonwealth heads of government assemble from time to time to exchange views on important international issues. At these meetings, the leaders seek to identify common goals in economic and foreign affairs. They work to coordinate their national policies to pursue these goals. But the nations are not required to obey conclusions reached at the conferences.

The Commonwealth of Nations conducts various programs through Commonwealth agencies. For example, several jointly financed programs provide economic aid and technical assistance to developing nations in the group. The Commonwealth also supports agencies that promote cooperation in such activities as broadcasting, cable and satellite communication, education, health care, and scientific research.

The Commonwealth Secretariat leads and co-ordinates Commonwealth activities. The secretariat has its headquarters in London.

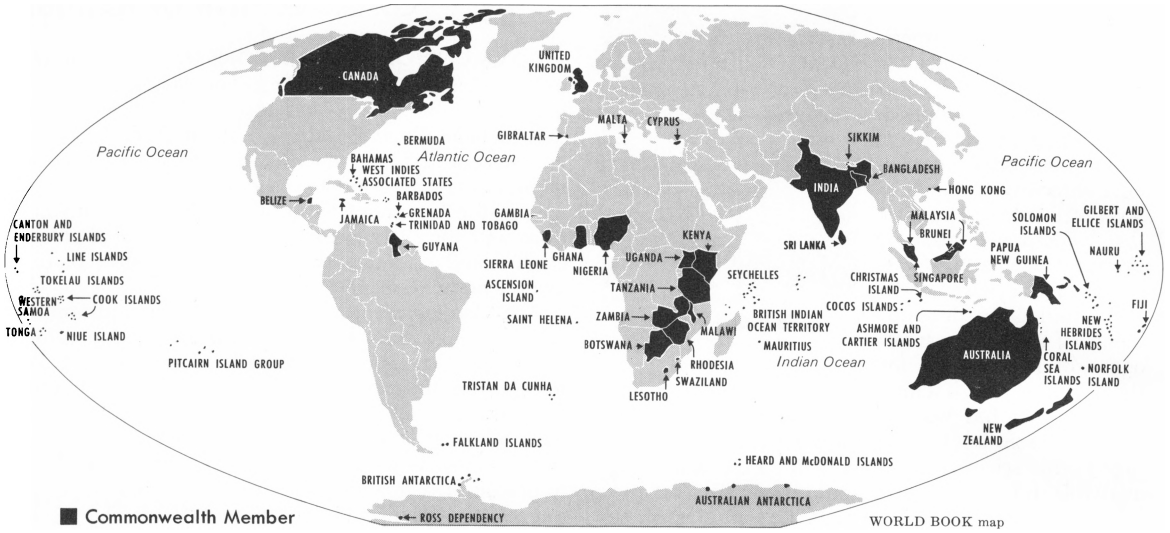
Independent Members of the Commonwealth are former British colonial areas, dependencies, or dominions that have become self-governing but have retained their Commonwealth ties. Despite the Commonwealth's tradition of cooperation, each nation has its own foreign policy, which reflects its own interests.

All of the independent members recognize the British monarch as head of the Commonwealth. But the monarch is mainly a symbol and has no real power to govern. Britain and about 10 other Commonwealth nations are monarchies that regard the British ruler as head of state. A few others have their own monarchs. About half the Commonwealth nations are republics.

West Indies Associated States were formed in 1967. They include Antigua, Dominica, St. Christopher (St. Kitts)-Nevis-Anguilla, St. Lucia, and St. Vincent. They are self-governing in all matters except defense and foreign affairs, which are the responsibility of Britain. The states can break this tie at any time.

Dependencies are Commonwealth areas that do not have complete self-government. They are administered by independent Commonwealth members. Most dependencies are developing toward self-government.

A majority of the dependencies are territories that have been annexed to the British Crown. This means that persons living in them are British citizens. These dependencies were formerly called *colonies* or *crown colonies*. A governor appointed by the British government is the highest official in each such dependency. He holds all political power in some dependencies. But others have elected assemblies, and in them the governor's power is limited. Some of the dependencies have become practically self-governing. Most of these areas



THE COMMONWEALTH OF NATIONS

Members	Location	Status
INDEPENDENT MEMBERS		
Australia	Pacific Ocean	Monarchy
Bahamas	Atlantic Ocean	Monarchy
Bangladesh	Asia	Republic
Barbados	Caribbean Sea	Monarchy
Botswana	Africa	Republic
Canada	North America	Monarchy
Cyprus	Mediterranean Sea	Republic
Fiji	Pacific Ocean	Monarchy
Gambia	Africa	Republic
Ghana	Africa	Republic
Grenada	Caribbean Sea	Monarchy
Guyana	South America	Republic
India	Asia	Republic
Jamaica	Caribbean Sea	Monarchy
Kenya	Africa	Republic
Lesotho	Africa	Monarchy
Malawi (Nyasaland)	Africa	Republic
Malaysia	Asia	Monarchy
Malta	Mediterranean Sea	Republic
Mauritius	Indian Ocean	Monarchy
Nauru	Pacific Ocean	Republic
New Zealand	Pacific Ocean	Monarchy
Nigeria	Africa	Republic
Sierra Leone	Africa	Republic
Singapore	Asia	Republic
Sri Lanka	Indian Ocean	Republic
Swaziland	Africa	Monarchy
Tanzania	Africa	Republic
Tonga	Pacific Ocean	Monarchy
Trinidad-Tobago	Caribbean Sea	Monarchy
Uganda	Africa	Republic
United Kingdom	Atlantic Ocean	Monarchy
Western Samoa	Pacific Ocean	Republic
Zambia	Africa	Republic
WEST INDIES ASSOCIATED STATES		
Antigua	Caribbean Sea	Associated State
Dominica	Caribbean Sea	Associated State
St. Christopher (St. Kitts)-Nevis-Anguilla	Caribbean Sea	Associated State
St. Lucia	Caribbean Sea	Associated State
St. Vincent	Caribbean Sea	Associated State
DEPENDENCIES OF THE UNITED KINGDOM		
Belize	Central America	Dependency
Bermuda	Atlantic Ocean	Dependency
British Antarctic Territory	Antarctica	Dependency
British Indian Ocean Territory	Indian Ocean	Dependency
British Virgin Is.	Caribbean Sea	Dependency
Brunei	Asia	Sultanate
Canton and Enderbury Islands	Pacific Ocean	Joint Administration
Cayman Islands	Caribbean Sea	Dependency
Channel Islands	English Channel	Crown Dependencies
Falkland Islands	Atlantic Ocean	Dependency
Gibraltar	Europe	Dependency
Gilbert and Ellice Is.	Pacific Ocean	Dependency
Hong Kong	Asia	Dependency
Man, Isle of	Irish Sea	Crown Dependency
Montserrat	Caribbean Sea	Dependency
New Hebrides Is.	Pacific Ocean	Condominium
Pitcairn Is. Group	Pacific Ocean	Dependency
Rhodesia	Africa	*Self-governing Dependency
Saint Helena	Atlantic Ocean	Dependency
Seychelles	Indian Ocean	Dependency
Solomon Is. (British)	Pacific Ocean	Protectorate
Turks and Caicos Is.	Caribbean Sea	Dependency
TERRITORIES OF AUSTRALIA		
Antarctica (Aust.)	Antarctica	Territory
Christmas Island	Indian Ocean	Territory
Cocos (Keeling) Is.	Indian Ocean	Territory
Coral Sea Islands	Pacific Ocean	Territory
Heard and McDonald Islands	Indian Ocean	Territory
Papua New Guinea	Pacific Ocean	Self-governing Territory
Norfolk Island	Pacific Ocean	Territory
DEPENDENCIES OF NEW ZEALAND		
Cook Islands	Pacific Ocean	Self-governing Territory
Niue Island	Pacific Ocean	Self-governing Territory
Ross Dependency	Antarctica	Territory
Tokelau Islands	Pacific Ocean	Territory

*Britain considers Rhodesia a dependency, though Rhodesia declared itself independent in 1965. In 1970, it declared itself a republic.

are ruled as though they were parts of Great Britain.

The term *dependency* may also refer to other kinds of political units. These include *condominiums*, *crown dependencies*, *joint administrations*, *protected states*, *protectorates*, *self-governing territories*, *territories*, and *trust territories*.

Condominiums are controlled by two nations that share administration of the territory.

Crown dependencies are self-governing territories annexed by the British Crown. They are not bound by acts of the British Parliament unless named.

Joint Administrations are controlled by two nations that have interests there. Each nation has responsibility for its own property and personnel in the area.

Protected States are independent countries that have made treaties with Great Britain for protection. These protected states control their own internal affairs, but permit the British government to manage their defense and foreign relations. The people who live in protected states are not citizens of Great Britain. Each state has its own executive officials. A commissioner represents the Crown in protected states.

Protectorates control their own internal affairs. But a Commonwealth nation has final responsibility for the maintenance of orderly government in the protectorate and manages its foreign affairs.

Self-Governing Territories control their own internal affairs. They have agreed to let a Commonwealth nation handle their foreign relations. But they have the right to declare full independence at any time.

Territories are dependencies of Australia or New Zealand. Each territory has an administrator chosen by the government of Australia or New Zealand. In some territories, this official holds all political power. In other territories, he shares power with an elected assembly. Some territories have become nearly self-governing. Australia and New Zealand are responsible for the defense and foreign policy of their territories.

Trust Territories are former colonies of nations that have been defeated in war. For example, some of Germany's colonies in Africa and the Pacific Ocean were put under control of Commonwealth nations after World War I. They were called *mandates* by the League of Nations. After World War II, these former colonies were called *trust territories* by the United Nations. The Commonwealth nations administer these trust territories until their people gain independence.

History. The Commonwealth of Nations began to take form in the early 1900's. At that time, representatives of certain British colonies met with British representatives at Imperial Conferences. All these colonies had self-government in domestic affairs. But Britain managed their foreign policy and defense.

During the 1910's and 1920's, the self-governing colonies moved toward independence in foreign affairs. Representatives at a 1926 Imperial Conference declared all participating countries to be completely self-governing nations. They described these nations as equal in rank, "united by a common allegiance to the Crown and freely associated as members of the British Commonwealth of Nations." The Statute of Westminster, a British law of 1931, legalized the 1926 declaration. The original Commonwealth members were Australia, Britain, Canada, Ireland, New Zealand, Newfoundland, and South Africa.

In 1932, the Commonwealth nations established a system of trade called *Commonwealth Preference*. Under this system, Britain imported goods from other Commonwealth countries without imposing the usual tariffs. Other Commonwealth nations negotiated favorable trade agreements with each other.

Between 1947 and 1970, about 30 more British colonies became independent nations. Nearly all of these nations joined the Commonwealth. During the same period, Newfoundland became a province of Canada, and Ireland and South Africa gave up Commonwealth membership because of disagreements with other countries in the group. By the mid-1960's, black African nations made up nearly half the Commonwealth membership.

In 1973, Britain began a four-year plan to discontinue most of its special trade arrangements with Commonwealth nations. It took this action when it joined the European Community, an organization of Western European nations that cooperate in economic and other matters. Several other Commonwealth members negotiated trade agreements with the Community. See EUROPEAN COMMUNITY.

ROSS N. BERKES

Related Articles. All of the countries and most of the dependencies in the accompanying table have separate articles in WORLD BOOK. Other related articles include:

Colony	Flag (color pictures)	Territory
Condominium	Governor General	Trust Territory
Crown Colony	Protectorate	

COMMUNAL SOCIETIES, *KAHM yuh nuhl*, emphasize collective ownership and cooperative work. They discourage members from pursuing individual objectives. No one owns private land, and each person is responsible to some extent for the care and well-being of everybody else. The clearest cases of communal societies exist among primitive peoples.

In the 1800's, such European thinkers as the Comte de Saint-Simon, Robert Owen, Charles Fourier, Étienne Cabet, and Pierre Joseph Proudhon reacted against the liberalism and individualism of the time. They sought a cure for the evils in society through some form of communal society that would prevent unearned wealth but would allow some private ownership. These ideals inspired many communities in Europe and the United States. Other thinkers, such as Karl Marx, wanted to set up a communal society in which everyone was absolutely equal and no one owned private property (see COMMUNISM). Examples of present-day communal societies include collective farms such as the *kibbutzim* of Israel (see ISRAEL [Agriculture]).

JOHN F. CUBER

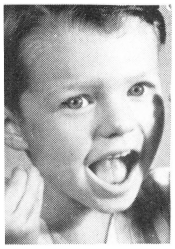
Related Articles in WORLD BOOK include:

Amanites	Hutterites	Oneida Community
Brook Farm	New Harmony	Shakers

COMMUNE, *KAHM yoon*, is the smallest district of local government in France and some other countries. It resembles the *township* in the United States. The French commune has a mayor (*maire*) who governs the town with the help of deputies and a council. A commune may be a small village or a large city. Usually 12 communes make up a *canton*, the next largest political division. See also CANTON.

ROBERT E. DICKINSON

COMMUNICABLE DISEASE. See DISEASE (introduction; How Diseases Spread; table).



COMMUNICATION

Communication reaches us by means of hearing and seeing, and sometimes by means of tasting, smelling, and touching. We communicate by talking, writing, signaling, gesturing, singing, drawing, and even by dancing. Man has developed such devices as radio, television, telephones, and motion pictures to communicate with people beyond the ordinary limits of sight and sound.

SEE

HEAR

SMELL **TASTE** **TOUCH**

Ewing Galloway

COMMUNICATION means sharing information. We communicate with each other in many ways. A baby cries when it is hungry. We wave hello or good-by to our friends. Even animals use sounds and movements to share information. For example, a dog barks and wags its tail to show joy. Machines also communicate. A dial on the dashboard of an automobile indicates the temperature of the engine. Important methods of communication include letters, books, magazines, newspapers, signs, radio and television broadcasts, advertisements, and motion pictures.

Wilbur Schramm, the contributor of this article, is Director of the East-West Communication Institute and author of Responsibility in Mass Communication *and* Television in the Lives of Our Children.

Communication is a basic human activity. If it suddenly disappeared, our whole way of life would crumble. We would have no governments and no elections, no laws and no courts, no cities and no nations, no schools, no advertising, and almost no entertainment.

Communication has made the world "smaller." Radio can send the human voice around the world faster than it can be shouted from one end of a football field to another. Persons talking by telephone between Pittsburgh and Paris can hear each other as quickly as if they were talking in the same room. Without modern means of communication, it would take months, or even years, to share information with people in far parts of the world who can now be reached in a few seconds.

The Importance of Communication

In Daily Life, communication is with us from the time we wake up until we go to bed. The ringing of the alarm clock tells us it is time to get out of bed. A cheery voice from the kitchen tells us that breakfast is ready. As we walk to school or drive to work, traffic lights tell us whether we can cross streets safely. In school, books and teachers help us share information about our world. On the job, high-speed communication makes modern business and industry possible. Newspapers tell housewives about bargains in neighborhood shopping centers. Radio and television weather reports help us plan what to wear.

Communication also protects us. Radio broadcasts alert policemen so they can rush to the scene of a crime or accident. Fire alarms send fire trucks speeding on their way to battle blazes. The scream of an ambulance siren warns traffic so that doctors can bring sick persons to hospitals quickly and safely.

In Business and Industry, salesmen rush their orders to factories by telephone and telegraph. Stock tickers flash the news of ups and downs in stock-market prices. Newspapers and magazines bring businessmen up-to-date information on business conditions.

Advertising is one of the most important means of business communication. Every time we pick up a newspaper, read a magazine, or tune in a radio or television program, we see advertisements. These tell us about products we may want to buy or things we may want to do. Modern advertising reaches millions of people at the same time. If an ad is successful, it makes a large number of persons want to buy the same product. This enables manufacturers to use modern mass-production methods to turn out thousands of the same product cheaply and quickly. Therefore, communication also helps make products available at low cost.

In Agriculture, speedy communication helps protect crops against floods, frosts, and other hazards. The farmer was once isolated, but today, broadcasts keep him in touch with developments. If orange growers in Florida or California hear a warning of an approaching cold wave, they can quickly light smudge pots to keep frost from their orchards. Blizzard warnings enable cattlemen to protect their grazing livestock.

Communication helps farmers in other ways. Newspapers, magazines, and government bulletins bring news of the latest developments in agriculture. A government bulletin might tell a farmer about a new insect killer. Communication also brings the latest news about crop and livestock prices. These enable farmers to sell their products when they can earn the most money. The telephone enables farm families to call their neighbors, or, in an emergency, to summon help.

In Transportation. Communication and transportation are so closely linked that they are difficult to separate. Before the mailman can deliver a letter, for example, it must be transported from one place to another. Airplanes, trains, and ships carry mail across oceans and continents. Trucks and mailmen take the mail from post offices to homes. Newspapers, magazines, and books would be almost useless if they were not transported from one place to another.

Communication often makes transportation possible. Semaphore signals tell train engineers whether the track ahead is clear. Radio and radar guide airplanes to safe landings. Charts help sailors bring their ships into harbors. Road signs and road maps keep us from getting lost when driving or hiking. In these and many other ways, communication and transportation depend on each other. See TRANSPORTATION.

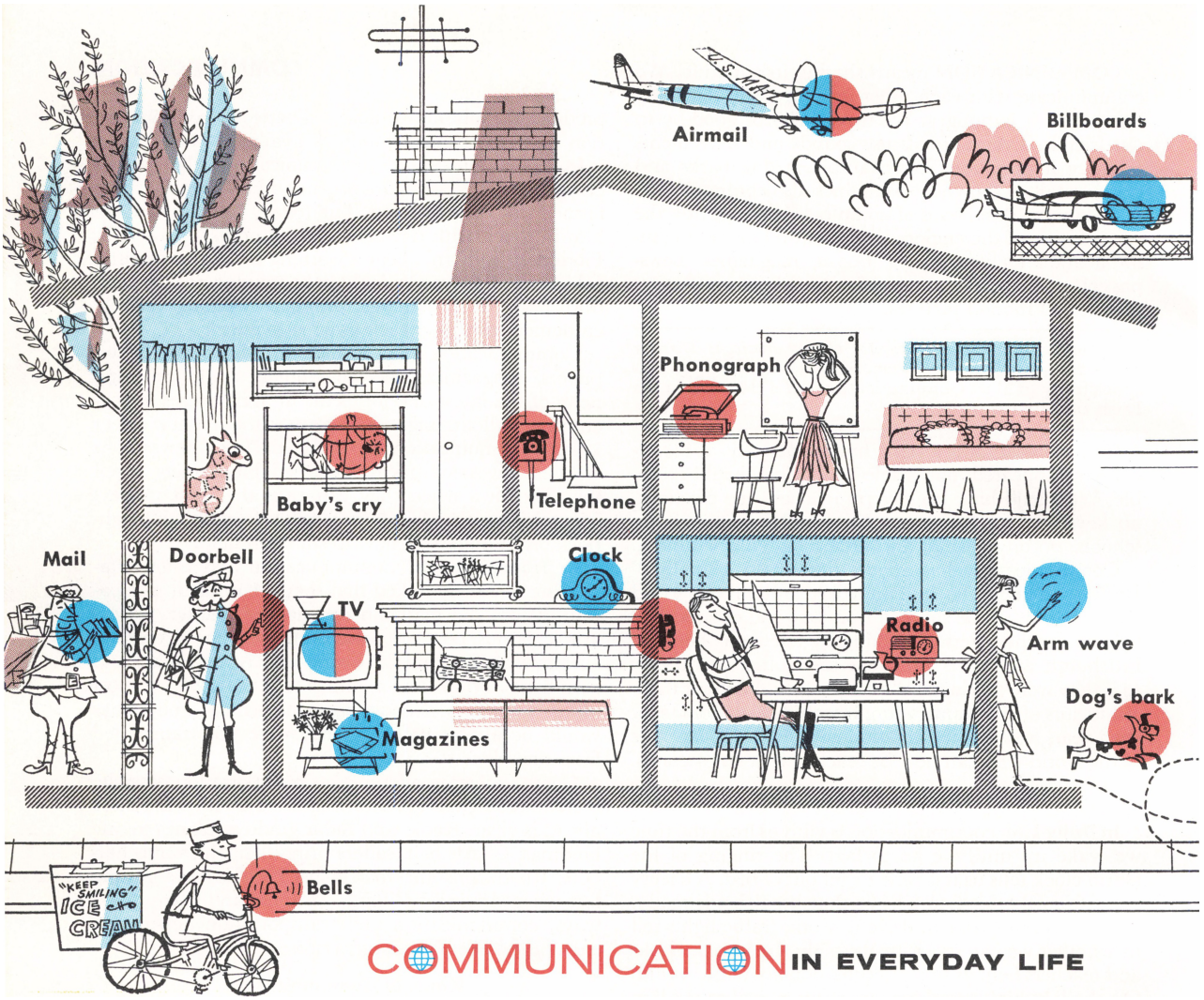
Kinds of Communication

Gestures and Signals. Much of our communication is face to face and without words. We smile. We frown. We tip our hats. We hold up our hands in one way to say that we want to recite in class, and hold them up in another way to say "stop." A person may squeeze a friend's hand to communicate sympathy or love. We share a variety of information about how we feel by the expressions on our faces and the tones of our voices.

People have also learned to use signals so that they can communicate over greater distances. Woodsmen may make cuts in trees or build piles of stones to show others a path through a forest. Primitive tribes send smoke signals. Doorbells signal the arrival of visitors. Students listen for the buzzer that tells them when a class begins and ends. When the telephone rings, we know someone is calling us. See SIGNALING.

Pictures and Symbols. In the caves of prehistoric men, explorers have found colorful, lifelike drawings of prehistoric animals and hunters. One explorer came across a crude image of a bear made of clay in a prehistoric cave in France. Bears were probably dangerous enemies of cave men. The explorer guessed that the cave dwellers danced around the clay bear and jabbed it with sticks.

These cave pictures and sculptures illustrate a great



Communication plays a part in almost everything we do at home, in school, at work, and at play. The brown circles indicate sound communication, and the blue, sight communication.

advantage in communication that man has over animals. He can make better *symbols* (things that stand for other things). *Words* are the easiest of all symbols to use, whether written or spoken. Words are the names given to everything we see and know. See SYMBOL.

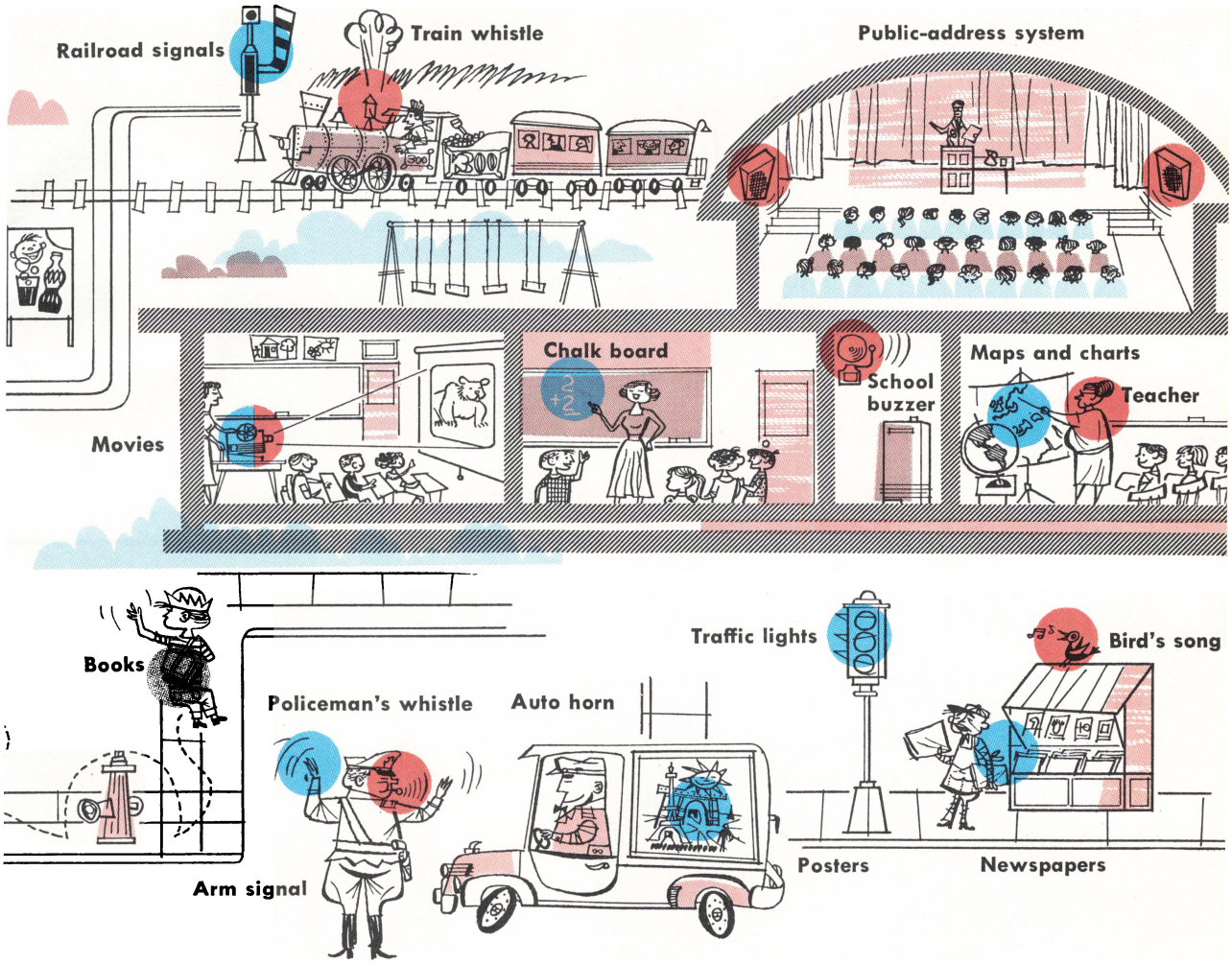
Language and Writing. After the development of words, the development of language became the next great step in communication. Language is a systematic way of using words so that people can share information efficiently. Every language has two elements: (1) a group of words whose meaning is understood by everyone who uses the language, and (2) an accepted way of linking these words so they can be used together. The English language has dictionaries that tell what words mean. It also has a system of grammar that tells how these words can be put together in sentences.

Not all written languages use words. The ancient Egyptians wrote a language that used pictures called *hieroglyphics* (see HIEROGLYPHIC). Mathematics is a kind of number language. It has certain meanings for each of its symbols, with patterns of relationships between them. Multiplication tables and axioms of geometry show relationships among numbers (see MATHEMATICS).

Language and writing give us a way to communicate more than simple experiences. A person need not communicate only about hunger, food, and cold. With language and writing, he can discuss scientific theories and write poetry. He can record his history as he makes it.

Language and writing have also made it possible for people to share information even if they are not close together. A person can write a letter to a friend who lives far away. He can put up a sign that says "Stop" without having to be there to hold up his hand. He can take a series of electrical buzzes, use them to mean words, put them on a telegraph line, and communicate with people on the other side of the world. He can speak sentences into a microphone and be heard on every continent. See LANGUAGE; WRITING.

Mass Communication is the sharing of information with many people in many places with the help of machines. Machines produce the books, magazines, newspapers, radio programs, television programs, and films that are the *media* (means) of mass communication. A newspaper brings a reporter's knowledge of an event to thousands of readers. Millions of persons can watch a baseball game on television. Motion-picture



audiences in all parts of the world can enjoy the excitement of a movie drama.

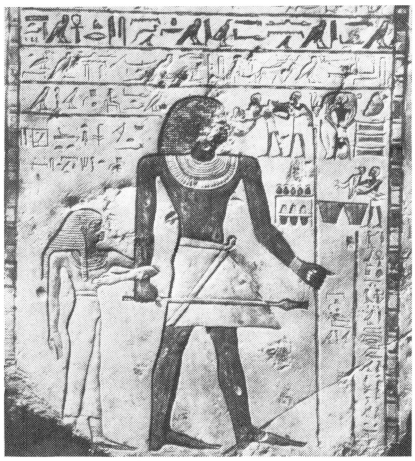
Sharing the information delivered by mass communication takes up more of the time of people in the United States and Canada than any other activity except working and sleeping. Mass communication teaches us many of the things we know about the world we live in. Cameras, microphones, and teletypes serve as eyes and ears to tell us about wars, politics, sports events, and scientific discoveries. Libraries and reference books bring us the accumulated knowledge of the ages. Weather, news, and market reports help us predict future events. Mass-communication media make new plays, music, and other kinds of entertainment available everywhere, not just in a few large centers.

Development of Communication

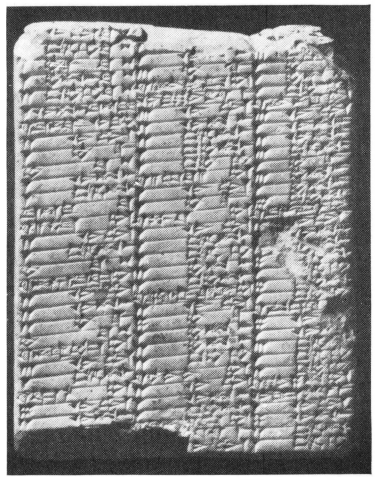
We do not know just when man first learned to talk. Nor do we know who was the first man to use a sound to describe an object or an event, and make someone else realize that the sound was its name. Perhaps this first talker was playing with his voice, as small children play with their fingers and toes. Perhaps he was imitating some sound of nature. But he began language when he connected a sound with a particular thing.

After men began to talk, thousands of years must have passed before there was any written language. In different parts of the world, men fitted names to things and put together their own forms of language. More than a thousand language "communities" developed in which men still speak their own tongue. This huge number slows communication and makes understanding difficult.

Written Language. In very early times, man probably began to try to keep records and to communicate over long distances. After he had fire, he developed smoke signals. He sent messengers and questioned travelers. Traveling minstrels brought him news as well as songs (see MINSTREL). He had simple business dealings and built little markers to indicate the boundaries of his property. He also put knots in cords or notches in sticks to record what was owed him. Hunters drew pictures in the sand or on cave walls to record their triumphs, or perhaps to show younger men how to hunt. As man's language developed, he began to string pictures together to make picture stories. Finally, his



Oriental Institute, University of Chicago



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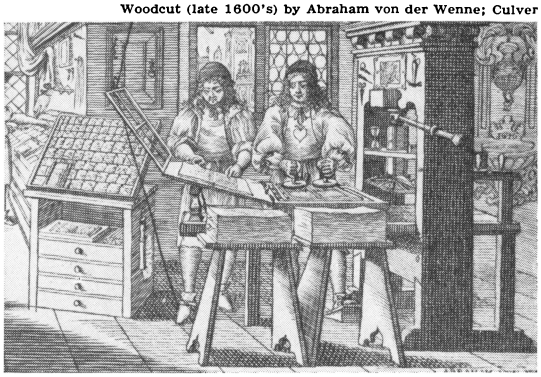
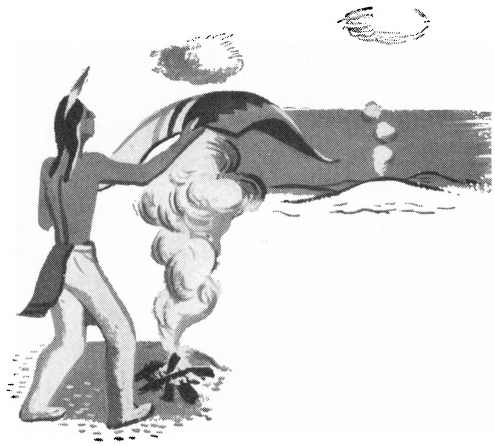
Ancient Forms of Writing included Egyptian hieroglyphics, *left*, a picture language, and Babylonian cuneiform, *above*, a system of wedge-shaped writing. Both developed before 3000 B.C.

Printing in the 1500's was a laborious job. Printers set and inked the type by hand and printed on crude presses.

Woodcut (late 1600's) by Abraham von der Wenne; Culver



Indians Used Smoke Signals to send long-distance messages. The number and spacing of the smoke puffs had various meanings.



IMPORTANT DATES IN COMMUNICATION

Before 3000 B.C. The Egyptians developed a picture language called *hieroglyphics*. At the same time, the Sumerians were writing on clay tablets with *cuneiform*, a system of writing that used wedge-shaped signs.

c.2500 B.C. The Egyptians used papyrus sheets for written records.

c.1500 B.C. The Semites devised an alphabet.

600's B.C. The Assyrians and Babylonians established libraries, including the Royal Library at Nineveh.

322 B.C. Aristotle made one of the first attempts to bring all existing knowledge together in a series of books.

c.300 B.C. The Hindus invented numerals.

c.200 B.C. Parchment was developed in western Asia.

63 B.C. Marcus Tullius Tiro, a Roman slave, invented a system of shorthand.

c. A.D. 70's Pliny the Elder edited his *Natural History*, the oldest reference work in existence.

c.105 The Chinese used paper and ink.

700's Block printing was practiced in Asia.

c.800 The Arabs adopted our present number system from India.

c.868 The oldest preserved block-printed book, *The Diamond Sutra*, was printed.

c.1440 Gutenberg invented movable metal type.

1539 The first printing press in the Western Hemisphere began operating in Mexico City.

1622 European newsletters developed into printed newssheets called *corantos*, which were somewhat like newspapers. The first English coranto, the *Weekly News*, was published.

1639 Stephen Daye established the first press in the American colonies in Cambridge, Mass.

1665 The first English newspaper, the *London Gazette*, appeared.

1702 The first daily newspaper in English, the *Daily Courant*, was published in London.

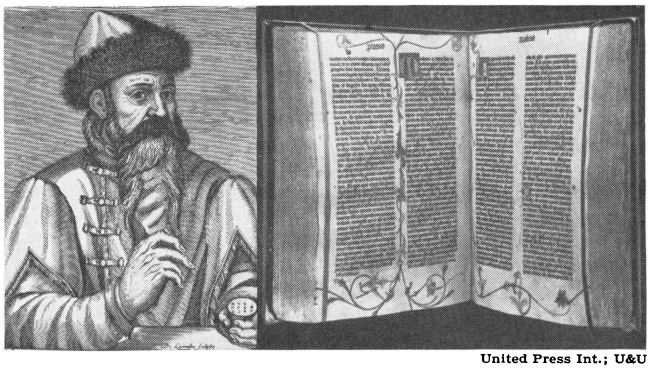
1704 The *Boston News-Letter*, America's first newspaper that lasted more than one issue, was published.

1731 The first magazine, the *Gentleman's Magazine*, was published in London.

1741 The first magazine in America, the *American Magazine*, appeared in Philadelphia.

The Newberry Library, Chicago

Monks in the Middle Ages Copied Books by Hand. They carefully copied manuscripts letter by letter. Because of the time this took, books were scarce until printing developed.



United Press Int.; U&U

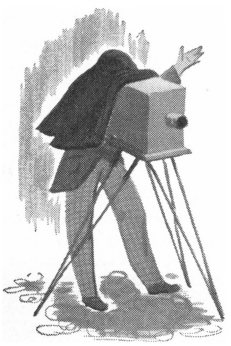
Johannes Gutenberg, Inventor of Movable Metal Type, made printing possible. The famous Gutenberg Bible, *right*, one of the earliest books printed in Europe, dates from before 1456.

The Secret of Making Paper from Wood was discovered by the French scientist René Antoine de Réaumur in the early 1700's. He observed how wasps chewed up wood to make paperlike nests.

Scott Paper Co.

Daguerreotype Pictures, invented in 1839, were one of the first successful means of photography. They used copper plates coated with silver iodide that had to be exposed several minutes.

Eastman Historical Photographic Collection



IMPORTANT DATES IN COMMUNICATION

1755 Samuel Johnson published *Dictionary of the English Language*, one of the first English dictionaries.

1783 The first daily newspaper in America, the *Pennsylvania Evening Post and Daily Advertiser*, was founded in Philadelphia.

c.1803 The Fourdrinier brothers in England perfected a machine for making paper.

1814 The cylinder press was developed.

1828 Noah Webster published the first comprehensive American dictionary.

1826-39 Joseph Niépce and Louis Daguerre of France invented a method of photography.

1833 The first public library was established at Peterborough, N.H.

1837 The Massachusetts legislature established free public education under state supervision.

1844 Samuel Morse sent the first public telegraph message.

1858 The first transatlantic cable was laid.

1867 Christopher Latham Sholes, Carlos Glidden, and S. W. Soulé made the first practical typewriter.

1876 Alexander Graham Bell invented the telephone.

1877 Thomas A. Edison invented the phonograph.

1889 George Eastman developed a practical photographic film.

1894 Motion-picture projectors were perfected.

1895 Guglielmo Marconi invented the wireless telegraph.

1918 The world's first regular air-mail service was established between New York City, Philadelphia, and Washington, D.C.

1923 Pictures were televised between New York City and Philadelphia.

1927 Sound pictures appeared in American theaters.

1941 Commercial television began in the United States.

1957 The first artificial earth satellite sent back information from space.

1959 Russian and American rockets sent back information from beyond the moon.

1962 Television programs were relayed between the U.S. and Europe via the satellite *Telstar I*.

1965 The U.S. launched the first commercial communications satellite, called *Early Bird*.

ability to speak grew greater than his ability to record what he knew. Then he took a great step toward written language. He could already speak and draw pictures. Now he began to make a picture equal a word.

It took a long time to draw every picture in detail. So, about five or six thousand years ago, man learned to simplify his pictures. The simplified pictures became the first written language. This language was rather awkward to use, because there was no good material to write on. Words had to be cut in stone, scratched on wax tablets, or marked in clay before the clay hardened. But picture writing was greatly superior to any earlier means of communication. Now man could record a promise, write history, and send messages great distances without depending on a messenger's memory.

The Alphabet. After man had a picture language, it took him about two thousand years to develop an alphabet. The Semitic peoples of Syria and Palestine probably developed the first alphabet about 1500 B.C. The Semites used picture-symbols of about 20 simple objects to represent the different sounds in their speech. These symbols included ones for ox, house, hand, fish, and teeth. By combining these symbols in a line, they could write any spoken word. This alphabet became the pattern for the Greek and Roman alphabets. It also formed the basis of our English alphabet. See ALPHABET and the separate articles for each letter of the alphabet.

The invention of the alphabet ranks as one of the great events in human history. As the alphabet spread throughout the world, it freed men from the burden of learning a different symbol for each word. As a result, learning to read became much easier, and more people learned. Writing was simpler, and more was written. The use of the alphabet encouraged study and discovery. Writing became a convenient tool for commerce and news gathering. Laws could be published widely.

The Growth of Communication was very rapid between the development of the alphabet about 1500 B.C.

COMMUNICATION THROUGH THE YEARS

John Hancock Mutual Life Insurance Co.

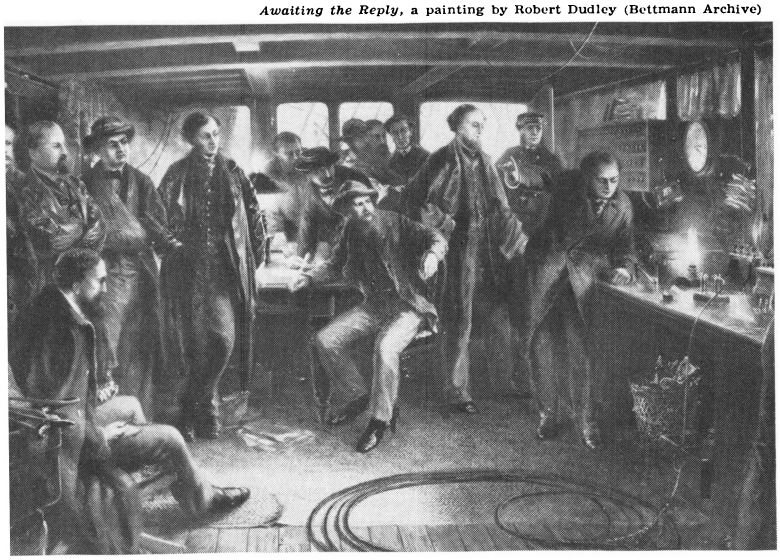
"What Hath God Wrought!" was the first public telegraph message sent by Samuel F. B. Morse on May 24, 1844. This picture shows a reenactment of the famous event.

The Pony Express served as the fastest means of transcontinental communication during its short life in 1860-61.

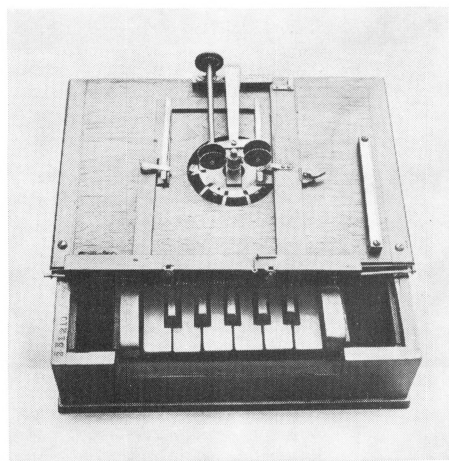
Library of Congress

The First Successful Transatlantic Cable opened in 1866. The painting *below* shows the men who laid the cable awaiting a reply from Ireland.

Awaiting the Reply, a painting by Robert Dudley (Bettmann Archive)



Ewing Galloway



The First Practical Typewriter looked like a piano. It was invented in 1867 by Christopher Sholes, Carlos Glidden, and S. W. Soulé.

and the beginning of printing from movable metal type about A.D. 1440. The Egyptians were using papyrus paper by 2500 B.C. (see PAPYRUS). Parchment paper was being used in the Mediterranean area by 200 B.C. (see PARCHMENT). The first libraries, probably built by the Assyrians, appeared in the 600's B.C. The Greeks established libraries throughout the ancient world, including the one at Alexandria founded in the 200's B.C.

Some of the world's greatest literature came from Greece, Rome, and the eastern Mediterranean region between 1000 B.C. and A.D. 400. Postal service began with messenger service provided by Cyrus the Great in the Persian Empire during the 500's B.C. Pliny the Elder developed an encyclopedia in the A.D. 70's. During the A.D. 100's, Ptolemy drew parallels of latitude and longitude on the early maps.

The Romans had what might be called the first newspaper, which they posted each day outside the Senate. They called it the *Acta Diurna*, or daily proceedings of the Senate. It was a handwritten newspaper, and

FAMOUS FIRST WORDS

"What hath God wrought!" Samuel F. B. Morse sent this message from Washington, D.C., to Baltimore over the world's first commercially practical telegraph line on May 24, 1844.

"Europe and America are united by telegraphy. Glory to God in the highest, on earth peace, and good will toward men." On Aug. 16, 1858, this transatlantic message was sent over the first submarine telegraph cable, laid by Cyrus Field.

"Mr. Watson, come here. I want you." Alexander Graham Bell spoke these words, the first communication by telephone, in a hot Boston attic in 1876.

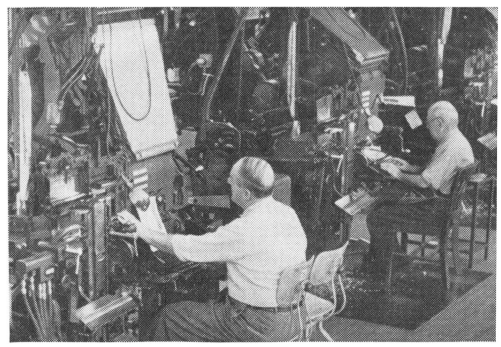
"Good morning, Mr. Edison. Glad to see you back. I hope you are satisfied with the kineto-phonograph." When Thomas A. Edison returned from Europe in 1889, his assistants had a surprise for him. Edison glued his eye to a peephole and saw motion pictures of an assistant synchronized with a phonograph speaking these words.

"S." On Dec. 12, 1901, the repeated sound of this letter in Morse code came clearly to Guglielmo Marconi in St. John's, Newfoundland. This signal, the first long-distance wireless message, came from Cornwall, England.

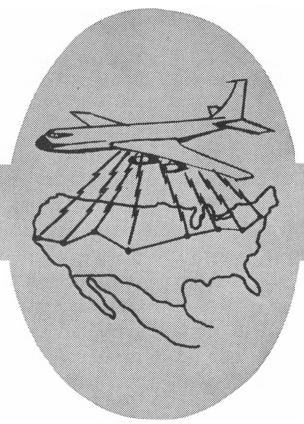
A. T. & T. Co.

A New York-to-Chicago Call became possible in 1892 when Alexander Graham Bell, *left*, opened the first long-distance telephone line to link the two cities.

The Linotype Machine, *right*, invented by Ottmar Mergenthaler in 1884, replaced hand setting of type. This speeded up printing newspapers, magazines, and books.



Chicago Sun-Times



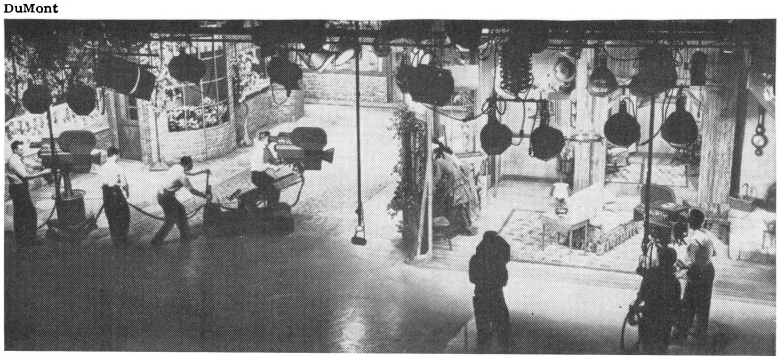
RCA

Guglielmo Marconi, the "Father of Radio," developed the wireless telegraph in 1895. This was the ancestor of TV and radio.

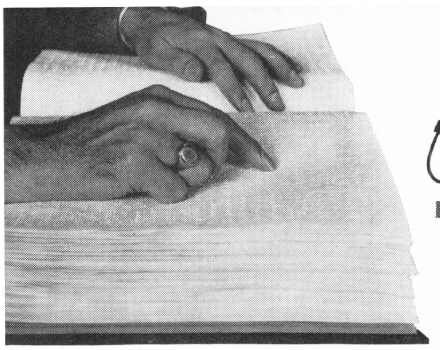
Westinghouse

Listening to Radio in 1920 required the use of earphones to pick up the weak signals received by the early sets.

DuMont



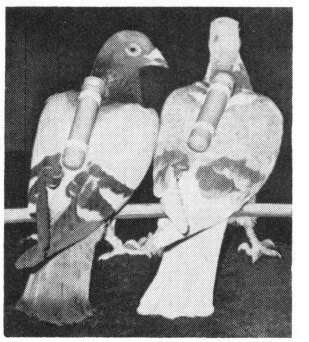
The Modern Miracle of Television brings sight and sound to millions of homes. TV studios such as this were unknown before the 1940's when television first became practical.



Chicago Public Library

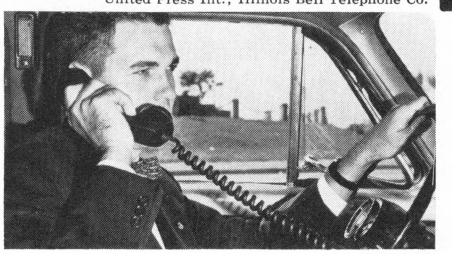
The Blind Read with Their Fingers using the Braille system of dots on paper.

UNUSUAL MEANS OF COMMUNICATION



Homing Pigeons have been messengers for thousands of years. They carry messages on their backs or legs.

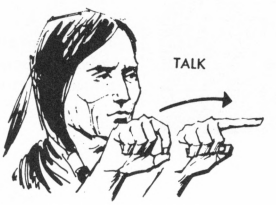
United Press Int.; Illinois Bell Telephone Co.



Telephones on Wheels aid doctors, salesmen, and other busy persons. Car telephones work by radio.

Bettmann Archive

Communicating with Drum Beats is an important means of sending messages from place to place used by some tribes in Africa.



Indian Sign Language uses hand signals to stand for ideas or things. The signals gave Indians a universal language.

only a few copies of the paper were made each day.

Monks of the Middle Ages wrote beautiful books on parchment with ink and color. These books could be made by hand only, one at a time. There was no economical way to make more copies of books until printing from movable type developed. See Book (picture, Copying Manuscripts).

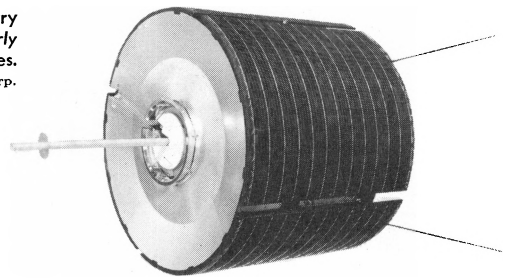
Printing from Movable Type. Printers in China, Japan, Korea, and India had printed from carved wooden blocks for about 700 years before printing was known in Europe. Both paper and ink had been invented in China as early as the A.D. 200's. They reached Europe by way of the Moslem countries. The people of Korea even knew of movable type.

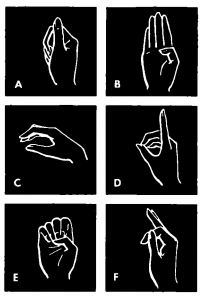
Europe's first printer was Johannes Gutenberg. He did four important things: (1) used ink and paper developed in Asia; (2) designed a press similar to that used for squeezing wine grapes; (3) cast metal type so that it could be used over and over again; and (4) used the alphabet from the Mediterranean countries. Gutenberg put these four ideas together into a single operation. He had to design and cast only 26 letters to print anything that had been written. Without the alphabet, he would have faced the same difficulties as Asian printers who had to work with thousands of picture-symbols. See Gutenberg, Johannes.

Printing developed in western Europe at a time when people wanted knowledge, news, and commercial information. Europeans had just discovered the Americas. Great scientific discoveries were being made. More persons had become interested in government and trade. Presses were soon founded in most European countries. A press was opened in Mexico City in 1539, and Stephen Daye established one in Cambridge, Mass., in 1639. These presses printed religious books, schoolbooks, and newspapers. See Printing (History).

Through the ages, news has been reported by travelers; by government reports such as the *Acta Diurna;* by town criers; by professional newsletter writers; and, finally, by newspapers, magazines, radio, and television. For the first hundred years after the development of movable type, newsletters enjoyed great popularity. For a large fee, an English tradesman could subscribe to a letter with the business news from Hamburg. For a smaller fee, Venetians could buy a page of notes issued by the government of Venice. This Venetian newsletter

Communications Satellites such as *Early Bird, right,* can carry telephone, television, and other electronic communication. *Early Bird* relays messages between Europe and the United States.
Communications Satellite Corp.

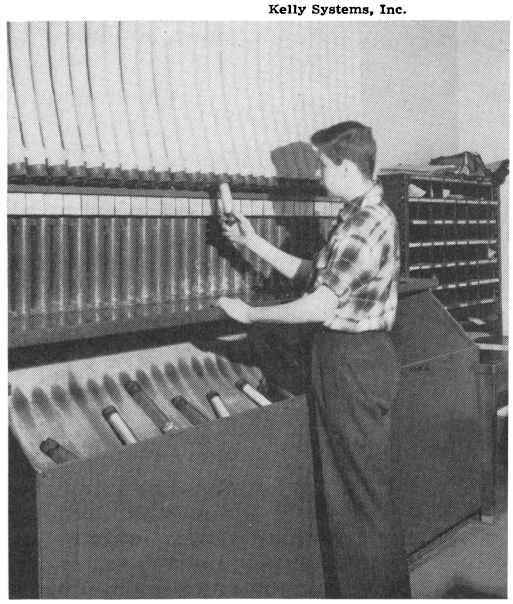




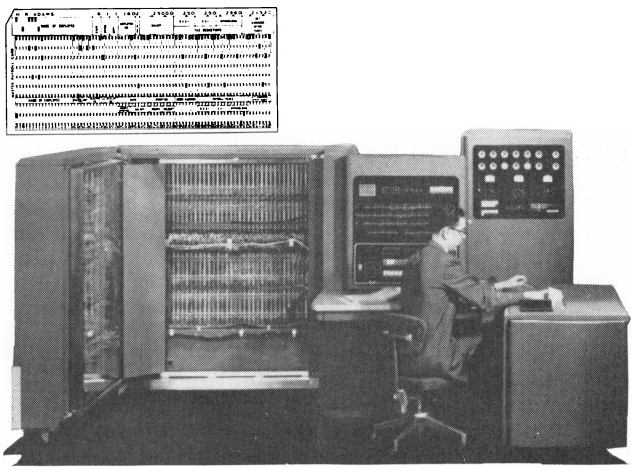
Wide World

Sign Language for the Deaf uses hand signals to stand for letters and numbers. Here, deaf persons use signs to auction items at a bazaar.

Pneumatic Tubes carry messages short distances in department stores, newspaper plants, and other places. Air pressure shoots message tubes through the pipes.
Kelly Systems, Inc.



Communication with Machines is done by means of punched cards that feed information to a computer. This card gives payroll information to a computer that automatically prepares a pay check.
International Business Machines Corp.



became so popular that it had to be printed. About 1609, a German newsletter appeared in print. The first news sheet in England was printed in 1621. The British colonies in America had no printed newsletter or newspaper until 1690, when Benjamin Harris published a newspaper in Boston. It was called *Publick Occurrences Both Forreign and Domestick.* The colonial government suppressed it after one issue. The first daily paper in America, the *Pennsylvania Evening Post and Daily Advertiser,* began in 1783 in Philadelphia. See NEWSPAPER (History).

The Surge of Printing brought a wave of interest in democracy, literacy, and education in America and western Europe. As more persons learned to read, they became more concerned with government. Now they had ways to communicate their dissatisfactions. Printing became a weapon in the English, French, and American revolutions. These revolutions gave the common man much more importance in government. To take advantage of this new importance, he not only had to be able to read the news and editorials, but also to have the knowledge and thinking ability that comes from education. Free public education developed. As more people became educated, they needed more printed materials. Political, intellectual, educational, and communication revolutions all occurred together.

Printing is really only the use of a machine to reproduce language. It could be called *machine-duplicated* communication. Until the mid-1800's, almost every improvement in mass communication consisted of ways to improve machine-duplication and to use it for more things. During the early 1800's, people learned to operate presses with steam power. Others learned to etch plates with acid and to print pictures from them. About 1803, two brothers in England, Henry and Sealy Fourdrinier, invented a machine for making paper fairly cheaply and quickly. In 1828, Noah Webster produced the first comprehensive American dictionary. Three Milwaukeeans invented the typewriter in 1867. Until 1884, each piece of type was set by hand. In that year, Ottmar Mergenthaler of the United States invented the *linotype,* which uses a keyboard like that of a typewriter to set type mechanically.

Great efforts were made to speed the circulation of news and mail. For example, the daring young riders of the Pony Express braved wind, rain, snow, desert,

COMMUNICATION AND TRANSPORTATION

William Eccles

Communication and transportation depend on each other. Railroads, airlines, and other means of transportation require good means of communication, such as the lantern signal, *left*, to operate efficiently. Communication also depends on transportation. A helicopter, *right*, delivers mail to an airport for loading onto waiting airliners.

mountains, and hostile Indians to carry the mail from the Missouri frontier to California. They usually took 10 days to race over the route, but sometimes made it in 8 or 9 days by cutting stops. They set a new record in 1860 when they carried the news of President Abraham Lincoln's election from Fort Kearny, Neb., to Fort Churchill, Nev., in six days. But this was almost the end of the pony express. The telegraph was bringing a new era to communication. See PONY EXPRESS.

Electronic Communication has made it possible to send messages over long distances in a fraction of a second. The first major development in electronic communication was the telegraph, invented in the 1830's. It sends coded electric messages over wires.

In 1876, Alexander Graham Bell invented the telephone, the first device to transmit the human voice over electric wires. Thomas A. Edison invented a machine called the *phonograph* that recorded sound. Guglielmo Marconi found a way to send signals through the air without using electric wires. By 1907, Lee De Forest had developed the vacuum tube that made it practical to send the human voice through the air electronically.

The 1800's and early 1900's brought another exciting chapter in communication history. As early as 1826, men had learned how to take photographs. They were taking colored pictures as early as 1861. Photography developed somewhat slowly, because pictures had to be taken on glass plates rather than film. George Eastman provided a workable camera film in 1889. During the 1890's, Thomas A. Edison, Charles Francis Jenkins, and others developed motion pictures. In 1927, people began to see—and hear—the first sound pictures.

Motion-picture and broadcasting techniques were combined to create television. TV began on an experimental basis in the early 1920's, and commercially during the 1940's.

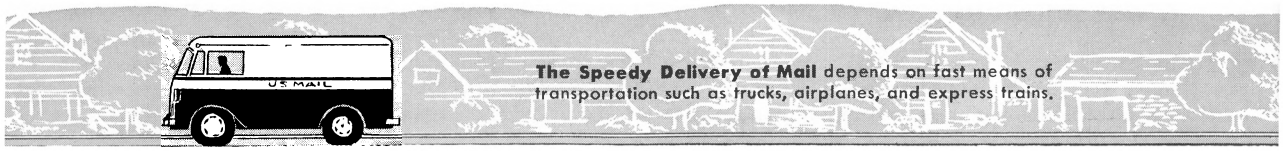
During the 1950's and 1960's, methods were developed for sending communications over long distances by means of communications satellites. The first satellites, such as *Echo*, simply reflected radio and television waves from one ground station to another. Later, satellites were equipped with solar-powered amplifiers that picked up the waves and rebroadcast them to the receiving station. The first commercial communications satellite, called *Early Bird*, began operating in 1965.

The Communication Industry has become one of the most important in the world. This growth has been closely related to an increase in *literacy* (the ability to read and write). When Gutenberg developed movable type about 1440, probably fewer than 10 out of 100 adults in the world could read. In the 1800's, only about 20 out of 100 adults were literate. Today, more than 97 out of 100 persons in the United States above the age of 8 can read. About the same proportion of persons can read in Russia, Canada, and most of the countries of western Europe. In some of these nations, the percentage is even higher. Only a few underdeveloped nations have a literacy rate as low as that of the entire world during the early 1800's.

The United States has the largest system of mass communication in the world. It uses almost two-thirds of the world's supply of newsprint, and has more than half of the world's radio and television sets. The United States has about 1,800 daily newspapers, 8,800 weeklies, 16,500 magazines, 7,500 radio stations, and 900 television stations. Each year, the American book industry publishes more than 15,000 books, and the motion-picture industry produces about 150 feature films.

The communication industry has grown not only in size, but also in the number of persons it reaches. Newspapers, radio, television, and magazines reach millions of people in the United States every day. The book industry sells nearly half a billion books a year. The people of the United States spend over $14 billion a year on mass communication, including advertising and public relations. But Americans spend many times this amount on all communication, including telephones, telegraph, and postal service.

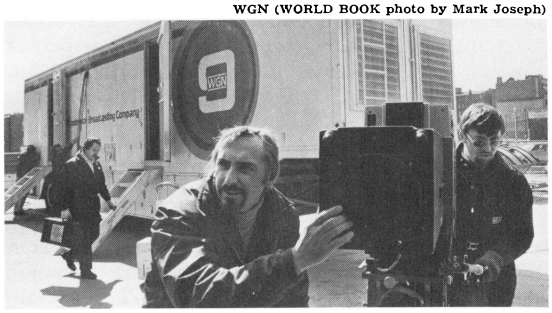
The communication industry has become highly developed in many other countries. Great Britain, for example, publishes about 460 copies of daily newspapers for every 1,000 persons. This compares with about 300 newspapers for every 1,000 Americans. Great Britain and Germany, and probably Russia, publish



The Speedy Delivery of Mail depends on fast means of transportation such as trucks, airplanes, and express trains.

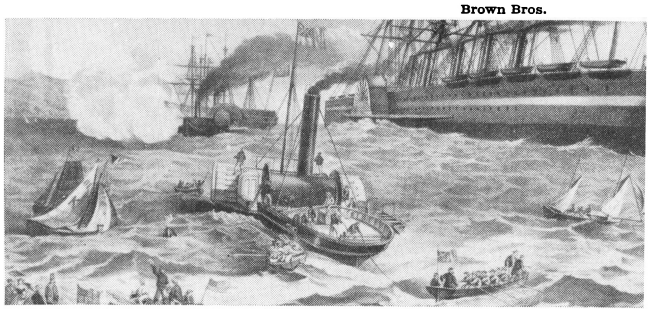
Mobile Television Units are housed in trailers that carry TV cameras and crews to the scene of various news events.

WGN (WORLD BOOK photo by Mark Joseph)



Transportation Provides Communication Links. Ships laid the first transatlantic telegraph cables in the 1800's.

Brown Bros.



more books than the United States. Even though Canada has a small population compared to the United States, it has an important and fast-growing communication industry. Canadians make more telephone calls per person than the people of any other country.

Recent Developments have brought revolutionary changes in communication. Man has developed machines such as radar that can peer into fog or darkness and tell him what lies ahead. Instruments used in airplanes tell pilots whether they are on course, and whether their planes are flying level. Pilots can make safe landings in bad weather, using only the information from their instruments. See AIRCRAFT INSTRUMENTS; RADAR.

The development of electronic computers has enabled engineers to design machines that run other machines. Scientists can feed information and problems into computers and receive answers. Some computers have been designed to play chess and to translate languages. In 1959, the United States Air Force and other organizations announced the development of a computer that could design a product and direct other machines how to make it. See AUTOMATION; COMPUTER.

The first man-made radio messages from space came from Sputnik I, the world's first artificial satellite launched by Russia in 1957. In 1959, Russian and U.S. rockets sent back messages from beyond the moon. The first radio communication with space travelers took place in 1961 and 1962 with the Russian cosmonauts Yuri Gagarin and Gherman Titov and U.S. astronaut John Glenn (see SPACE TRAVEL).

On Oct. 1, 1965, United States scientists set a record for communication distance. They sent a radio signal 191 million miles to the *Mariner IV* spacecraft and received a return signal. *Mariner IV* was farther from the earth than Mars was at the time.

Problems of Communication

It is not always easy to communicate exactly what we mean. We often find that we are misunderstood or cannot get our message across. This difficulty in communicating can produce serious, and even disastrous, results. For example, a person driving a car who misunderstands a policeman's signal might become involved in an accident. A garbled radio message might cause an airplane pilot to miss vital landing instructions. Even in sports, poor communication can produce disheartening results. A football player who misunderstands the instructions of his quarterback might cause his team to lose a game.

Misreading a message has sometimes changed the course of history. On Dec. 7, 1941, Japanese planes appeared on American military radar nearly half an hour before they attacked Pearl Harbor. But the Americans misread the radar's message, and thought the planes were friendly. If the Americans had interpreted the message correctly, they might have been able to get enough planes into the air to fight off the Japanese.

Problems of Personal Communication. The first problem to be solved in any system of effective communication is *delivering the message*. When two persons want to share information, one of them creates a message. He sends it and assumes that the other has received it. Suppose that Mr. Adams writes a letter and puts it in the mailbox. If he has put a stamp on the envelope, if he has put the right address on it, and if nothing happens to it in the mails, the letter will reach the address of Miss Brown. If Miss Brown remembers to look in the mailbox, if she does not drop the letter and lose it, if she is not too busy, and if she cares to read Mr. Adams' letter, the message will be received.

Next, *the message must get attention.* Does a boy hear his mother calling him? Do you hear the telephone ring? Do you catch the little gesture with which your friend gives special meaning to what he says? How many books in the library have you never taken from the shelves? Those unread books are messages that have never come to your attention. You tune in only a few of the many television and radio programs from which you can choose. You read only a fraction of the news.

Third, *the message must be interpreted.* In some ways, this is the most difficult problem of communication. For a while, the message exists away from both the sender and the receiver. It has a life of its own. It may be a letter going through the mails, sound impulses in

the air caused by speech, or ink marks on paper. It may be electric impulses broadcast in the air, shadows cast on a motion-picture screen, or paint on canvas.

The person who receives a message always interprets it in terms of his own experiences. If the sender and receiver have not had the same experiences, the message may not mean exactly the same thing to the receiver. If the sender has had an unpleasant experience with school, and the receiver has had only pleasant experiences, a message about school will not mean the same thing to both of them. A message in German means nothing to one who does not speak German.

The study of meanings of words is called *semantics* (see SEMANTICS). Students of semantics find that different persons give different meanings to the same message. There have been experiments in which the same face has been described by different people as happy, sad, angry, pleasant, friendly, and unfriendly. This is because people have had different experiences which they relate to that particular facial type.

Another basic problem in communication is that *the message must be accepted and acted upon.* Suppose a mother calls her son in to dinner. Even if the boy hears the message and understands it, he still may not come. Perhaps he has become too absorbed in a game of baseball. Or perhaps he is not hungry, or simply feels like disobeying. We do not buy all the goods which advertisements urge us to buy. We do not believe all we hear. In general, the more strongly we feel about something, the less likely we are to let a message change our minds about it. For example, researchers have learned that many more Republicans than Democrats tend to read Republican campaign advertisements, and vice versa.

Problems of World Communication resemble those of personal communication. But they are more difficult because of the distances and differences that separate people in various parts of the world. People in countries that lie far apart often hear little about each other. Some governments *censor* messages (see CENSORSHIP).

Nearly 3,000 languages are spoken throughout the world. One person could never hope to understand all these languages. Few persons can understand even two of them well. So language is a barrier to the sharing of information throughout the world.

Culture is an even greater barrier. *Culture* means the rules and patterns by which people live (see CULTURE). Cultures differ greatly in different countries, and people rely on vastly different experiences to interpret messages. In India, for example, the cow is a sacred animal and the people would not think of eating its flesh. When the Indians read about *roast beef*, they may be sickened and disgusted. Americans might have a pleasant sensation of good food. Different experiences with government may make words such as *freedom* and *democracy* mean different things in different countries.

Almost every nation tries to persuade other nations to accept its point of view. This persuasion often takes the form of private talks or notes exchanged between representatives of the governments. These exchanges form part of *diplomacy* (see DIPLOMACY). Persuasion by means of public messages is called *propaganda.* It faces the same problems as other types of communication in trying to be effective. Governments spend considerable money and effort on propaganda. See PROPAGANDA.

A number of international organizations have been established to improve world communications. For example, the United Nations provides a place in which nations can discuss their mutual problems.

Government and Communication

In the United States, the government has as little as possible to do with the communication system. In fact, the various communication media check on various government functions. Obviously, if the newspapers or broadcasting systems are to check on the government, they should not be controlled by the government. The Communications Satellite Act, passed by Congress in 1962, specified that a private corporation be created to develop a communications satellite system. It limited the government's role in the organization.

The chief power of the U.S. government over media is the right to assign frequencies for radio and television stations (see RADIO [Government Regulation of Radio]; TELEVISION [Government Regulations]). The government was not permitted to do even this in the early days of radio. When many stations came on the air, broadcasts began to interfere with each other. Finally, the public and the station owners demanded that the government assign frequencies to keep the stations apart.

The Federal Communications Commission assigns radio and television frequencies (see FEDERAL COMMUNICATIONS COMMISSION). The Federal Trade Commission investigates reports of misleading advertising in order to protect the public (see FEDERAL TRADE COMMISSION). Copyright laws enable authors to register their work so it cannot be stolen (see COPYRIGHT). Other laws protect the public against obscene material in print, on the screen, or on the air (see OBSCENITY AND PORNOGRAPHY).

The government operates the postal service at a low cost to users. It provides especially low rates for newspapers, books, and magazines, so they can be easily available. The government also regulates utilities such as the telephone and telegraph industries.

The government interferes little with the content of communication. The Federal Communications Commission is forbidden by law to censor radio or TV programs. Whenever censorship commissions or the U.S. Post Office have suppressed material not obviously obscene or sacrilegious, the press and the public have protested loudly. Many courts, including the Supreme Court of the United States, have rendered decisions enforcing the rights of free speech and free press. See FREEDOM OF SPEECH; FREEDOM OF THE PRESS.

Most mass media have their own advisory or regulatory commissions and their own professional organizations to keep watch on the content of communication. The motion-picture industry, for example, has the Motion Picture Association of America. The National Association of Broadcasters maintains offices that read scripts and see and hear programs of its members. The radio and television industries, and newspaper, magazine, and book publishers have their own professional organizations, some of which discuss ethics.

In Other Democracies. The philosophy of keeping communications free from governmental control also exists in Canada, Great Britain, and many nations of western Europe and Latin America. Like the United

States, these countries have a political philosophy based on a faith in a "free market place of ideas." This means that if the different viewpoints on a question are freely available, men will be able to choose between truth and error. As a result, conflicting viewpoints on important matters must be fully and fairly represented.

In some democracies, the ownership of the means of communication differs from that of the United States. In Great Britain, for example, the British Broadcasting Corporation (BBC), a public organization, handles all radio broadcasts and operates a television network. Britain also has private TV stations. But, in spite of this government ownership, British law and tradition have enabled broadcasting to remain as free as that of the United States. Canada has a similar system, with the government-owned Canadian Broadcasting Corporation (CBC) owning several radio and television stations. Canada also has many private stations. See GREAT BRITAIN (Communication); CANADA (Communication).

In Dictatorships, the mass-communication media are controlled by censorship rules and other restrictions. Anything which the government does not want the public to know cannot be published or broadcast. The government usually owns the broadcasting systems in these countries. It decides who can own and operate newspapers, and sometimes suppresses or confiscates papers it does not like. In Russia and other communist nations, the mass-communication media function as a branch of the governments. WILBUR SCHRAMM

Related Articles. See the Communication section in the various state, province, and country articles, such as COLORADO (Communication); NEW BRUNSWICK (Communication). See also the following articles:

Advertising	Mathematics	Public Relations
Alphabet	McLuhan, Marshall	Publishing
Book	Motion Picture	Radar
Braille	Music	Radio
Computer	Newspaper	Reading
Education	Painting	Signaling
Encyclopedia	Phonograph	Speech
Invention	Photography	Symbol
Language	Post Office	Telegraph
Laser	Printing	Telephone
Library	Propaganda	Television
Literature	Public Opinion	Writing
Magazine		

Outline

I. **The Importance of Communication**
II. **Kinds of Communication**
  A. Gestures and Signals
  B. Pictures and Symbols
  C. Language and Writing
  D. Mass Communication
III. **Development of Communication**
IV. **Problems of Communication**
  A. Problems of Personal Communication
  B. Problems of World Communication
V. **Government and Communication**
  A. In the United States
  B. In Other Democracies
  C. In Dictatorships

Questions

How does the ability of people to read and write affect the communications in a country?

How can a machine communicate with men?

What effect did the development of modern printing have on political life in Europe and America?

How does culture affect communication?

What country has the largest system of mass communication in the world?

What nation makes the most phone calls per person?

What was the *Acta Diurna?*

What were Gutenberg's greatest achievements?

What are four problems of personal communication?

What is the chief power of the United States government over mass media?

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COMMUNICATIONS SATELLITE

COMMUNICATIONS SATELLITE is an artificial earth satellite used to send radio, telephone, television, or other electronic communications to any part of the world. Giant rockets launch the satellites into orbits around the earth. Transmitting stations on the ground then beam signals to the satellites by means of special antennas. The satellites send the signals back to the earth. The signals can be picked up by receiving stations that may be a third of the distance around the world from the transmitting station. Communication by satellite is more reliable than by ordinary short-wave radio and it has better quality. Communications satellites also can carry a wider range of radio *frequencies* (wave lengths) than short-wave radio can.

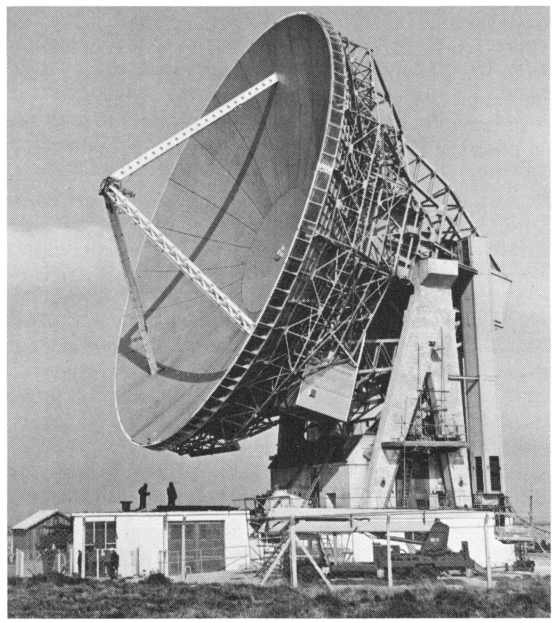
Kinds of Communications Satellites

A communications satellite is called *passive* or *active*, depending on the way it sends signals back to the earth.

Passive Communications Satellites simply reflect signals, as a mirror reflects light. The United States launched *Echo I*, the first passive communications satellite, in 1960. It was a huge, 100-foot (30-meter)

Communications Satellite Corp.

A Communications Satellite is prepared for launching by technicians. This *INTELSAT IV* satellite can relay up to 5,000 telephone conversations or 12 television programs at the same time.

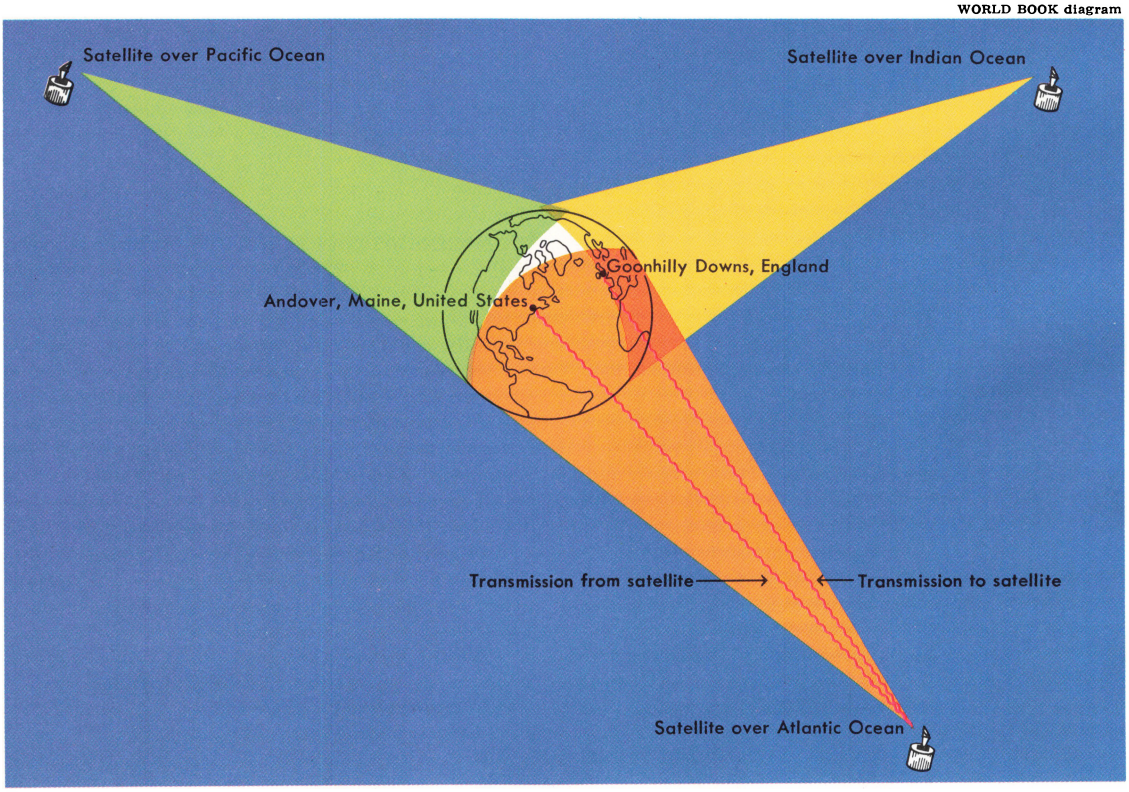


Communications Satellite Corp.

Ground Stations use huge antennas to send and receive signals to and from satellites. This station, at Goonhilly Downs, England, has an antenna 85 feet (26 meters) in diameter.

A Communications Satellite System uses three satellites to provide worldwide communications. For example, television pictures are sent from England to the United States through a satellite over the Atlantic Ocean. Both the sending and receiving stations must point their antennas at the satellite.

WORLD BOOK diagram



plastic balloon with a thin coating of metal. *Echo I* burned up as it re-entered the atmosphere in 1968. *Echo II*, similar to *Echo I* but larger, was launched in 1964.

The signals sent to passive satellites must be strong because radio waves weaken as they travel to a satellite and back to the earth. The satellite must be large to reflect the radio energy back to ground stations.

Active Communications Satellites carry a radio receiver and transmitter. They receive signals from the earth, *amplify* (strengthen) them, and then transmit them back to the earth. Therefore, they do not need to be so large as passive satellites. Most active satellites are less than 10 feet (3 meters) high. The electronic equipment in an active satellite gets its power from sunlight by means of solar batteries (see SOLAR ENERGY).

The United States launched several experimental active satellites during the 1960's. They included *Telstar*, *Relay*, and *Syncom*. These satellites relayed telephone calls, television programs, and other communications between the United States and Europe.

In 1965, the Communications Satellite Corporation (COMSAT) of the United States launched the first commercial communications satellite (see COMMUNICATIONS SATELLITE CORPORATION). COMSAT is a managing agency for the International Telecommunications Satellite Consortium (INTELSAT), an international agency that provides satellite communications between nations. COMSAT's first satellite, *Early Bird* or *INTELSAT I*, is an active satellite with 240 telephone channels. It also can carry television broadcasts between the United States and Europe. Similar *INTELSAT II*, *III*, and *IV* satellites were later launched. INTELSAT satellites over the Pacific Ocean provide service between the United States and Hawaii, Japan, the Philippines, and Thailand. Other INTELSAT satellites provide service across the Atlantic Ocean.

Since 1965, the U.S. Air Force has orbited more than a dozen communications satellites. Both the Air Force and the National Aeronautics and Space Administration (NASA) have pioneered in the field by launching experimental communications satellites. In 1965, Russia launched its first communications satellite, *Molniya I*. Since then, Russia has orbited other Molniya satellites.

Communications Satellite Systems

A series of orbiting satellites and a group of sending and receiving stations located around the earth form a communications satellite system. A series of satellites is necessary because a single satellite can serve less than a third of the earth's surface at a time. The sending and receiving stations must point their antennas directly at a satellite to complete a transmission. If the satellite is below the horizon, a ground station cannot use it.

Scientists and engineers have proposed various systems that would enable most ground stations to use at least one satellite at any time. Most systems use *synchronous satellites*, which stay in one position over the earth. Synchronous satellites are launched to an altitude of 22,300 miles (35,890 kilometers). At this altitude, the satellite's motion is *synchronized* with the earth's rotation. That is, the satellite completes one orbit during the time—a day—that the earth makes one rotation on its axis. Three of these satellites, properly placed, can link stations in any two parts of the world. All satellites now in use, except for the Russian Molniya satellites, are in synchronous or almost synchronous orbits.

The satellites launched so far have low-power transmitters, and large ground antennas are needed to receive their signals. Some scientists have proposed that more powerful satellites could be used to broadcast television directly to housetop antennas. Satellites also may be used for communication with airplanes, automobiles, and ships.

History

In 1945, Arthur C. Clarke, an English writer, proposed the idea of using satellites for communication. He suggested manned satellites placed in synchronous orbits. Radio operators in the satellites would maintain equipment that relayed messages to the earth. In 1955, John Robinson Pierce, an American scientist, proposed the use of unmanned passive and active satellites.

The first message transmitted by satellite—a recorded Christmas greeting by President Dwight D. Eisenhower—was sent in 1958. In 1969, the first television pictures from Apollo 11 astronauts on the moon were relayed around the earth by satellite. JOHN ROBINSON PIERCE

See also MAINE (picture: Satellite Station); SPACE TRAVEL (Artificial Satellites).

COMMUNICATIONS SATELLITE CORPORATION (COMSAT) operates a commercial communications satellite system. This system involves the transmission of telegraph, telephone, television, and other forms of communication, across oceans and continents.

Congress in 1962 authorized the establishment of COMSAT. It required that stock be sold to the public and to communications companies. COMSAT has about 114,000 stockholders. A 15-member board of directors governs the corporation. The public stockholders elect nine board members, the company stockholders select three, and the President appoints three.

COMSAT owns the largest single interest in the International Telecommunications Satellite Consortium (INTELSAT), an international agency. In 1965, COMSAT launched *Early Bird*, also called *INTELSAT I*, the first commercial communications satellite. Since 1965, COMSAT has launched more advanced satellites to create a worldwide communications system.

Critically reviewed by the COMMUNICATIONS SATELLITE CORPORATION

See also COMMUNICATIONS SATELLITE.

COMMUNION, *kuh MYOON yuhn*, in Christian churches, is the *sacrament* (holy ceremony) of the Last Supper. At the Last Supper, after pronouncing a blessing over bread and wine, Christ said to His disciples, "Take, eat. This is my body . . . This is my blood . . . This do in remembrance of me." Most Protestants call the sacrament *Communion*, or *The Lord's Supper*. The Eastern Orthodox Churches use the name *Holy Eucharist*. Anglicans call the ceremony *Holy Communion*. These two names are also used by Roman Catholics.

Some Protestant churches observe the ritual monthly or weekly. Others observe it every three months. Roman Catholics must receive communion during the Easter season, and often they receive weekly or daily communion. Communion, for Catholics, is an integral part of the Mass. FULTON J. SHEEN

See also MASS; TRANSUBSTANTIATION; VIATICUM.

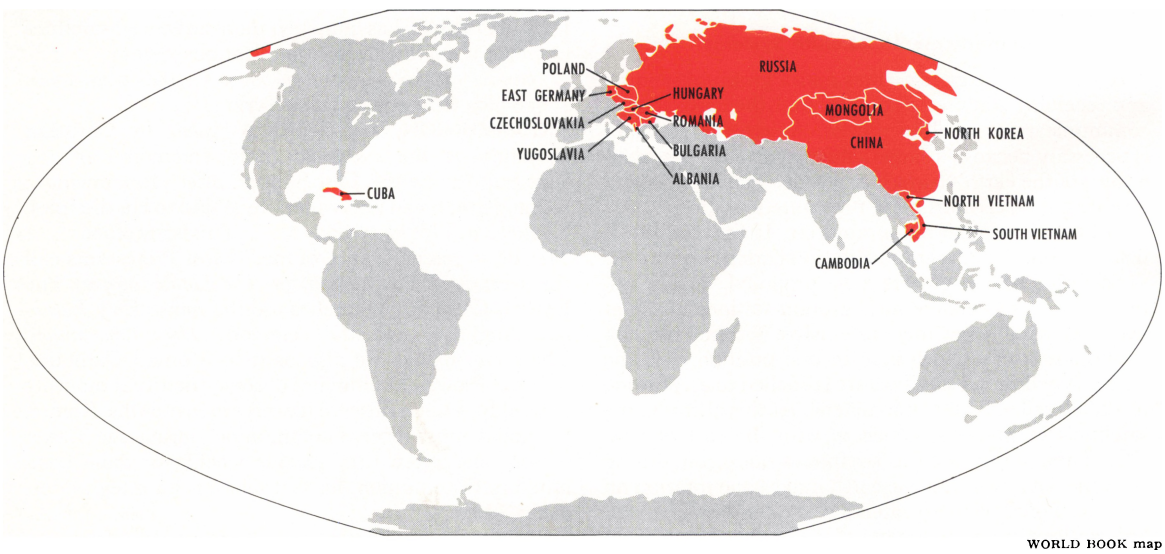
Sovfoto

Communists Celebrate the Russian Revolution of 1917 by holding huge parades. Marchers in Moscow's Red Square carry portraits of Karl Marx and V. I. Lenin.

COMMUNISM

THE COMMUNIST COUNTRIES OF THE WORLD

This map shows in red the countries with Communist governments. Communist rule has spread over large parts of the world since the Russian Revolution of 1917. Today, about a third of the world's people live in a country that has a Communist form of government.



WORLD BOOK map

COMMUNISM is a term that has several meanings. It can be a form of government, an economic system, a revolutionary movement, a way of life, or a goal or ideal. Communism is also a set of ideas about how and why history moves, and in what direction it is headed. These ideas were developed mainly by V. I. Lenin from the writings of Karl Marx. Lenin was a Russian revolutionary leader of the early 1900's. Marx was a German social philosopher who lived in the 1800's.

Communism has become one of the most powerful forces in the world. Its rise has shaped much of history since the early 1900's. Some persons consider Communism the greatest threat to world peace. Others look on it as the world's greatest hope.

According to Communists, their long-range goal is a society that provides equality and economic security for all. For the present, Communists call for government ownership—instead of private ownership—of factories, machines, and other basic means of production. They also call for government planning of economic activity, and for strict rule by the Communist Party.

Communists seek a world ruled by Communists everywhere. But different kinds of Communism have slowly developed, varying more and more from one another. Communist methods of gaining and holding power range from war and violent revolution to propaganda and education. Today, Communism has two principal meanings. First, it describes the parties that work to come to power in non-Communist countries. Second, it means the nations ruled by Communists.

Sixteen nations have Communist governments. The largest of these nations are Russia and China. More than a billion persons, or about a third of the world's population, live under Communist rule. Communist parties also operate in most non-Communist countries.

Communist states are dictatorships whose rulers permit little public or organized criticism. Communist leaders seek the support of the people, but they do not depend on it to stay in power as officials in democracies do. Communism permits little of a person's life to remain outside the party's control. Such a form of government is sometimes described as *totalitarian*.

The terms *Communism* and *socialism* frequently get confused. Communists usually refer to their beliefs and goals as "socialist," and Russia's official name is the Union of Soviet Socialist Republics. But socialists (often called *social democrats*) do not consider themselves Communists. Socialism may or may not be based on the teachings of Marx, but socialist beliefs are not based on the teachings of Lenin. Communism is based on the teachings of both Marx and Lenin. Communists and socialists both seek public ownership or control of the principal means of production. But most socialists favor peaceful methods to achieve their goals, while Communists have often been prepared to use force.

Communists speak of socialism as the present stage of development in most Communist countries. They consider it a very imperfect version of the "higher" Communist society they claim to be building. Therefore, when we speak of Communist countries, we do not mean that they have achieved full Communism. We merely mean that these countries are ruled by Communists.

The ideas of Marx and Lenin have been the common foundation on which Communists have built. In practice, some of these ideas have been whittled down or ignored. In the 1960's and 1970's, most Communist states have followed flexible policies.

This article presents a broad survey of Communism—what it is, how it works, and how it has developed. For a detailed description of life in a particular Communist country, read the WORLD BOOK article on that country. For a more complete understanding of Communism and other political or economic systems, read the articles on COLD WAR; DEMOCRACY; ECONOMICS; FREE ENTERPRISE SYSTEM; GOVERNMENT; and SOCIALISM.

COMMUNIST PARTY MEMBERSHIP

This table shows the estimated number of Communist Party members in each Communist country and in several non-Communist countries in 1973. The table also shows the per cent of the population of each country that belongs to the party. There are about 59 million Communist Party members in the world.

Country	Communist Party Members	Per Cent of Population
COMMUNIST COUNTRIES		
Albania	87,000	4
Bulgaria	700,000	8
Cambodia	*	*
China	28,000,000	3
Cuba	125,000	1
Czechoslovakia	1,250,000	9
Germany (East)	1,950,000	11
Hungary	760,000	7
Korea (North)	1,600,000	11
Mongolia	58,000	4
Poland	2,270,000	7
Romania	2,380,000	11
Russia	15,000,000	6
Vietnam (North)	1,100,000	5
Vietnam (South)	*	*
Yugoslavia	1,043,000	5
NON-COMMUNIST COUNTRIES		
Argentina	70,000	†
Australia	3,900	†
Canada	1,775	†
Chile	120,000**	1**
France	275,000	1
Germany (West)	35,000	†
Great Britain	29,000	†
Greece	28,000	†
India	180,000	†
Italy	1,617,000	3
Japan	350,000	†
Mexico	5,000	†
United States	16,000	†

*Non-Communist government overthrown by Communist forces in 1975; Communist Party membership unavailable.
†Less than 1 per cent.
**1972, latest available figures; Communist Party outlawed in 1973, after the overthrow of the government headed by Salvador Allende.
Sources: UN; U.S. Department of State.

Alexander Dallin, the contributor of this article, is Professor of History and Political Science at Stanford University, and editor of Diversity in International Communism *and* Soviet Conduct in World Affairs.

MAIN FEATURES OF COMMUNISM

Communism varies much from one Communist country to another. But certain basic features of Communism are more or less the same in all these countries.

The Communist Party is the Communists' main instrument for gaining and using power. In a Com-

munist country, the Communist Party is the only party with any power. Communists allow no political rivals, and voters have no real choice among candidates. They may vote for or reject the party's candidate, but often they cannot vote for anyone else.

The Communist Party in most countries is modeled after the Communist Party of the Soviet Union. It has strict membership requirements and is extremely demanding of its members. The party is highly *centralized.* That is, the top leaders make the important decisions. The Communist Party demands strict obedience of its members. After it has adopted a policy, all members must accept the "party line" until the leaders change it. For a discussion of the structure of a typical Communist Party, see RUSSIA (The Communist Party).

In most Communist countries, less than 8 per cent of the people belong to the Communist Party. The party seeks to sign up as members all those who hold important positions in such fields as education, government, and the military. In this way, the party can have some control over these fields. Communism teaches that Communists form a select group that is better trained and more responsible and reliable than any other. But for many persons, membership in the party is largely a way to get—and keep—a job.

Communism and Government. In Communist countries, party leaders play a key role in all major government decisions, and in seeing that they are carried out. The party is a link between the structures that support the ruling system, including the government, the police, the military, agriculture, and industry.

Most Communist countries have an elected national legislature, but these legislatures have little power. They usually pass without question all laws proposed by the Communist Party leaders. The extent to which the party itself runs a country varies according to time and place. For example, the party plays a far smaller role in Yugoslavia and Cuba than in Russia or Poland. But in each Communist country, a few persons occupy top positions in the party and the government.

In spite of the high degree of Communist organization and discipline, things do not always go smoothly. Bitter disputes often occur within the leadership of Communist parties and nations. Many of these disputes involve high-ranking Communists who take different sides in an argument over policy or a struggle for power. When a Communist Party leader opposes other leaders —for example, from industry or the military—the party leader almost always wins.

Communism and the Economy. Running the economy is a major responsibility of Communist governments. Communism prohibits the use of hired labor for private gain. In most Communist countries, the state owns most of the land, banks, natural resources, industry, and large-scale trade and transportation. The government also operates all mass communication, including broadcasting, television, publishing, and motion-picture production.

Individuals in a Communist country can own property, but the amount and kind vary from one country to another. Normally, a person may own his home, household goods, and personal savings. He also may own such personal items as books, musical instruments, a radio, and a television set. In some cases, he may cultivate his own small plot of land and own some livestock. Individuals can spend their money largely as they wish, but their choice is limited to what the government decides to produce or make available.

Major economic decisions are made by government planners and must agree with the policies of the Communist Party. The planners decide what and how much should be produced, and what prices should be charged for goods and services. In the United States, such decisions are usually made by individuals or corporations. The government planners must determine (1) what raw materials will be produced, (2) when and where they will be produced, (3) to whom and at what prices they will be sold, (4) what products they will be used for, and (5) how the finished products will be distributed. The planners must be sure that the right kinds of resources and skilled labor are at the right place at the right time. Compare this system to the American system as described in the article on ECONOMICS.

The farmland in most Communist countries is owned by the state. Farm workers on *state farms* receive wages from the government for their work. Farmers on *collective farms* are paid a share of the production and profits. The government lends the land to the collective farm. Most of it is worked jointly, but families on collective farms may cultivate small plots of land for themselves, and sell their products as they wish.

China has experimented—rather unsuccessfully—with large agricultural *communes.* In communes, large numbers of people are organized, as in an army, and told what to do. Meals are served in common dining halls, and young children are cared for in nurseries operated by the government. In contrast, most farmland in Poland and Yugoslavia is now privately owned and cultivated.

In Russia and Eastern Europe, the farm population has often been neglected or abused by Communist governments, and in earlier years the peasants strongly resisted Communist policies. Detailed government planning has also frequently held back farm managers in their attempts to use land and workers in the best way. Increasing agricultural production has been one of the major problems of Russia, China, and other Communist countries.

Labor unions in Communist countries exist mainly to help meet production goals. Unions also administer social insurance and operate vacation facilities. They have some influence on safety, job classifications, and employee complaints, but not on hiring workers or on wages. Unions in Communist countries are forbidden to strike against or picket the employer—the state.

Economic Change. There is no doubt that most Communist countries have made rapid progress in building up their industries. There are several reasons for their rapid industrial growth. For one thing, most of these countries had little industry when the Communists took over. The new rulers made industrialization one of their major goals. A Communist system can shift people and resources around more easily than a private enterprise system. For a while, it can concentrate on developing such heavy-industry products as steel and machine tools while neglecting the demands of con-

sumers for more and better food, clothing, and housing.

However, planning and centralization have also created problems. In the late 1960's, Russia and many East European Communist countries tried different schemes to improve production, quality, and efficiency. One method was to give plant managers greater freedom. They were offered bonuses for meeting or bettering the production and profit goals set for their firms. Communist governments also began to let customers have greater influence on the goods produced, and on the services made available to them. But so far, this has made little difference.

In Russia and Eastern Europe, many earlier economic notions have been given up. The governments no longer strive for equal income or equal wealth for all. Instead, they try to reward higher or better output with extra cash. Management is borrowing many ideas from American business. The ways of organizing and running Communist economies have become more and more varied, and experimentation continues. But in all cases, the leaders keep central control over natural and human resources. In China, industrialization is no longer a major goal.

LIFE UNDER COMMUNISM

Life under Communism varies from one country to another. The following section deals mainly with life under Communism in Russia and Eastern Europe.

Making a Living. The standard of living in the Soviet Union and the Communist countries of Eastern Europe is lower than that of the United States and Canada. But the differences were even greater before the Communists took over. Families spend a much smaller part of their budget on housing than American families do. Clothing is more expensive than in the United States. But education and medical services are free. Toys, household gadgets, bicycles, and cameras are scarcer and more expensive. Few families can afford a car. A far higher percentage of women have jobs in the Communist countries than in America.

Some persons in Communist countries make much more money than the rest. They include high party and government officials; and scientists, writers, and actors and other performers. However, the differences in income between the highest and lowest paid persons are much less than in the United States, and no one may—legally—accumulate a great fortune. In general, money plays a smaller part in Communist countries, and many people there believe that Americans are "money mad."

Education receives a great deal of attention in Communist countries. Communist schools stress science, mathematics, and languages. Training in science and engineering tends to be better—and more popular—than in the humanities and social sciences.

In the social sciences, students are taught only the official version. They have little chance to learn about or discuss other points of view. Some facts in history textbooks are changed to agree with the party line. Other facts are simply not mentioned at all. Since the mid-1950's, however, some untruths have been removed from Soviet and East European textbooks.

Leisure and Culture. Communists emphasize organized group leisure-time activity. Many persons belong to music, art, or folk dancing clubs. Such activities as scouting, arts and crafts, amateur theater, and stamp collecting are also organized into groups. These activities are often tied in with Communist youth organizations, which combine recreation and political instruction. Party leaders consider youth groups important in gaining support and, later on, party members.

Communist governments also encourage young people to take part in sports. Communist athletes compete against men and women from non-Communist countries in the Olympic Games and other international contests. There are many opportunities for such cultural activities as concerts, plays, and poetry readings. Many of these activities have a political theme. Persons in Communist countries have little opportunity to travel abroad. But it has become easier to see foreign movies, hear foreign radio broadcasts, and to learn about the outside world.

Personal Freedom. Communists consider their goal, their party, and the state more important than individual rights and liberties. In Communist countries, there are usually huge gaps between official claims of freedom and conditions as they actually exist. For example, Russia has a constitution that assures citizens freedom of speech, press, and assembly; and the right to a job and to leisure. The constitution guarantees freedom of religious worship and freedom of "anti-religious propaganda." It promises equal rights for all, regardless of race, sex, or nationality.

But the Russian government and party have violated or ignored many of the rights set forth in the constitution. Citizens may be punished if they publicly criticize the policies or leaders of the Communist Party. The government does not allow persons to establish organizations or newspapers that oppose it. Books, magazines, newspapers, and movies are valuable tools for promoting the party line. Writers who criticize the Communist outlook are not allowed to publish their work. Officials have had difficulty suppressing the distribution of unpublished writings of political dissenters.

Communists try to discourage religious worship because they consider religion a hostile force. Church membership may make it more difficult for a person to advance in his job, and impossible to join the Communist Party. In several countries—and especially in Poland and the Soviet Union—there has been much discrimination against Jews, even Jewish members of the Communist Party.

The trend since the mid-1950's has been toward tolerating some personal freedom. This was not the case during the rule of Joseph Stalin, the undisputed leader of world Communism from the late 1920's to the early 1950's. Stalin ordered millions of Russian peasants murdered or exiled when they resisted government attempts to seize their land. During World War II, five of Russia's nationalities were abolished and their members exiled because Stalin suspected these people of disloyalty. The peak of mass terror came between 1935 and 1938 in Russia, and again from 1948 to 1952 in Russia and Eastern Europe.

Stalin's successors gave up terror as a major weapon to control the people. The secret police have lost much of their power, and most forced labor camps have been

closed. But in a milder way, all Communist states continue to use threats and force. See STALIN, JOSEPH.

ORIGINS OF COMMUNISM

Modern Communism is based on the theories of Marx as interpreted and modified by Lenin. These theories are often called *Marxism-Leninism.*

Early Communism. The word *communism* comes from the Latin word *communis*, which means *common* or *belonging to all.* The idea of *communal* property dates at least from the time of the early Greeks. In the 300's B.C., the Greek philosopher Plato expressed communal ideas in his book *The Republic.* Plato proposed that a ruling class own everything in common, putting the welfare of the state above all personal desires. A number of early Christian groups had some form of community ownership of property.

Thomas More, an English statesman and philosopher, suggested in his book *Utopia* (1516) that all citizens share equally the wealth produced by industry. During the French Revolution (1789-1799), some extremists favored a revolutionary dictatorship to abolish private property. In the 1800's, communal ideas were practiced in such U.S. settlements as New Harmony in Indiana, Brook Farm in Massachusetts, and Oneida Community in New York.

Marxism. Marx's basic ideas were first expressed in the *Communist Manifesto* (1848), which he wrote with Friedrich Engels, a German economist. Marx believed the only way to ensure a happy, harmonious society was to have the workers in control. His ideas were partly a reaction against hardships suffered during the 1800's by workers in France, England, and Germany. Most factory and mine workers were poorly paid, and had to work long hours under unhealthful conditions.

Marx was convinced that the triumph of Communism is inevitable. He taught that history follows certain unchangeable laws as it advances from one stage to the next. Each stage is marked by struggles that lead to a higher stage of development. Communism, Marx declared, is the highest and final stage of development.

According to Marx, the key to understanding the stages of historical development is knowing the relationship between different classes of people in producing goods. He claimed that the owners of wealth are the ruling class because they use their economic power to force their will on the people. He held that *class struggle* is the means by which history moves from one stage to the next. Marx assumed that the ruling class would never willingly give up its power, and that struggle and violence were therefore inevitable.

Marx called for the abolition of *capitalism*, an economic system in which the chief means of production are privately owned. Under capitalism, Marx believed, a struggle takes place between the *bourgeoisie* (pronounced *BOOR zhwah ZEE*) and the *proletariat* (pronounced *PROH luh TAIR ee uht*). The bourgeoisie are the middle class, such as owners of factories and other means of production, and the proletariat are the workers. Marx argued that workers do not receive full value for their labor under capitalism, because the owners keep the profits. He believed that someday wealth would be in the hands of only a few persons, and the worker's living standards would continually grow worse. Finally, the workers would revolt and seize control of industry and the government.

According to Marx, the workers would establish a *dictatorship of the proletariat* that would work to set up a classless Communist society. Ultimately, everyone would live in peace, prosperity, and freedom. There would be no more need for governments, police, or armies, and all these would gradually wither away.

Capitalism has not collapsed as Marx expected it to. Wealth has become more widely distributed, and in most countries the poor have not become poorer nor a larger part of the population. No Communist country has been able to abolish social classes. Just as in non-Communist countries, some persons have more wealth and power than others. Conflicts and crime have not vanished in Communist society. Contrary to Marx's expectations, all workers do not show brotherly feelings for each other. Instead, national and racial hatred have often proved stronger than class ties.

COMMUNISM IN RUSSIA

Before 1917. Marx had expected his theories to be tested in Germany, Great Britain, or some other highly industrialized country. But it was in relatively backward Russia that Communists were first successful in setting up a Communist-controlled government.

During the late 1800's, Russia began to come out of its age-old backwardness. Although the country was still largely agricultural, its industry began to flourish. As industrialization increased, revolutionary activity grew. Radical Western ideas—including Marxism—became popular. In 1898, Marxists founded the Russian Social Democratic Labor Party. The party split into two groups in 1903. The *Bolsheviks* (members of the majority), led by Lenin, wanted the party to consist of a small group of disciplined revolutionaries. The *Mensheviks* (members of the minority) wanted the party to have wider membership and to reach decisions through democratic methods. In 1918, Lenin's group became the Russian Communist Party (Bolsheviks).

Lenin abandoned the Marxist idea that proletarian revolutions could be carried out only in highly industrialized countries with a large working class. He believed that backward areas offered a revolutionary movement other advantages. According to Lenin, the Communist Party would lead the workers and speak for them. To achieve its immediate goals, the party would seek temporary partners, including peasants and poor shopkeepers. After these goals had been reached, the party would feel free to turn against its former partners and form new alliances to achieve other goals. Thus, Lenin's theory of revolution actually called for the dictatorship of the Communist Party.

In 1905, thousands of Russians revolted against the czar, but the revolution was put down by the army. During the following years, the czar failed to bring about any basic reforms. World War I (1914-1918) created additional heavy problems for Russia. The nation suffered heavy troop losses on the front, and severe food shortages at home. In early 1917, the people overthrew the czar. A democratic *provisional* (temporary) government was set up.

Communism Under Lenin. In autumn, 1917, the Bolsheviks, led by Lenin, seized power and established a Communist government. When the Bolsheviks took over the government, they had fewer than 100,000 members in a country of over 160 million people. They succeeded partly because the provisional government had little experience. Its leaders did not want to withdraw from the war, and they could not carry out reforms while the war was still going on. The Bolsheviks also succeeded because of their effective organization, their appeal to the people, their willingness to act, and the clever leadership of Lenin.

Lenin led Russia from 1917 until his death in 1924. Soon after he came to power, Russia made peace with Germany, but from 1918 to 1920 Russia was torn by civil war between Communists and non-Communists. The Communists defeated their rivals, who were divided and poorly organized. From the start, Lenin used force and terror against his political opponents. By 1921, conditions had become grave throughout the country. Peasant and sailor revolts broke out, and famine threatened. The World War, revolution, and civil war had brought Russia near economic collapse.

In 1921, realizing the need for a change in policy, Lenin introduced the New Economic Policy (NEP). The NEP called for getting along with certain groups that were considered enemies of Communism. These included tradesmen, peasants, and middle-class engineers, scholars, and army officers. Russia's economy recovered steadily under the NEP.

By the time Lenin died, Russia had become a one-party state. All opposition had been banned, and all public organizations—such as workers' councils and trade unions—had been turned into tools of the Communists. See LENIN, V. I.

Communism Under Stalin. After Lenin died, leading Communists in Russia struggled for power. Through plotting and trickery, and by shifting alliances, Joseph Stalin gained complete control of the Communist Party and the Russian government by 1929. Until 1953, he ruled with an iron hand. Russia's economy and influence abroad grew rapidly—but at a great cost of human life and personal freedom in Russia.

In Stalin's view, no area of life could be outside the grip of the leader. Everything—even truth and morals—was a weapon at his service. In the mid-1930's, Stalin began to eliminate all opposition. He claimed to be *purging* (purifying) the Communist Party. Stalin ordered most of his earlier Communist associates arrested or put to death. Thousands of party officials, army officers, and factory managers were labeled "enemies of the people" and forced to confess imaginary crimes. The secret police sent millions to forced labor camps. See STALIN, JOSEPH (Rule by Terror).

For more detailed information on the development of Communism in Russia, see RUSSIA (History).

THE SPREAD OF COMMUNISM

The Comintern. Throughout the 1920's and 1930's, local Communists were active in many countries, but suffered severe setbacks in China, Germany, Poland, and Spain. The Bolsheviks thought the Russian Revolution of 1917 would spark revolution in other countries. But they soon realized that world revolution required careful direction and organization. In 1919, the Russian Communists helped establish the *Comintern* (Communist International). The Comintern united all the Communist parties of the world in a disciplined revolutionary organization, which became a tool of the Soviet leadership. All its attempts to promote revolution in other countries failed. Stalin had little faith in the Comintern, and it was dissolved in 1943.

World War II (1939-1945) provided opportunities for Communist gains in many countries. In 1939 and 1940, Russia took over Latvia, Lithuania, and Estonia, plus parts of Poland, Finland, and Romania. All this territory became part of the Soviet Union.

Toward the end of the war, Russian troops helped free many countries from German and Japanese control. Wherever possible, Russia set up Communist-controlled governments. Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and North Korea became independent "people's democracies." But these countries were actually Russian *satellites* (countries controlled by Russia). The satellites had to adopt Soviet political and economic practices and to follow the foreign policy of the Soviet Union.

In some other countries, Communists who had led national resistance movements during the war took power with little or no Soviet help. Local Communists took over the governments of Yugoslavia, Albania, and North Vietnam. Communists also became strong political forces in France and Italy, but were unable to take control there. In Greece, Indonesia, Malaya, and the Philippines, Communists lost their bids for power.

In China, the Communists and Nationalists joined forces to help defeat the Japanese, who had invaded the country in 1937. In the 1940's, the Chinese Communists gradually gained the upper hand over the Nationalists. By 1949, they had taken complete control of mainland China. See CHINA (Communist Victory).

In 1947, nine European Communist parties set up the *Cominform* (Communist Information Bureau). The Russians controlled the Cominform and tried to use it to keep the other parties in line. Yugoslavia was expelled in 1948 after President Tito refused to take orders from Russia. The Cominform then lost most of its effectiveness, and was finally dissolved in 1956.

Stalin died in 1953. Since then, Soviet armed forces have been in action only in other Communist countries. Russian troops crushed revolts in East Germany in 1953 and in Hungary in 1956. Fidel Castro became dictator of Cuba in 1959, and two years later declared his government to be Communist.

The Cold War. In the late 1940's, the United States and its allies promised to aid non-Communist countries that were attacked by a Communist country. The struggle between the Communist and non-Communist powers became known as the *Cold War*. The chief weapons of this war included propaganda, plus economic, political, and technological power.

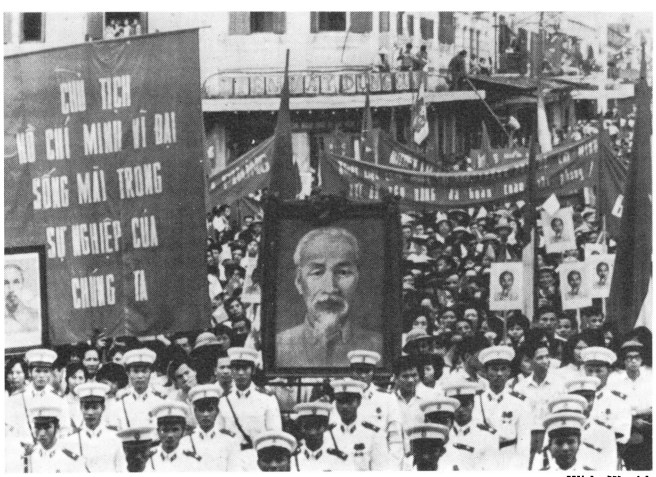
Since the beginning of the Cold War, most Communist attempts at expansion have failed. The Western powers won a victory in 1949, when they broke Russia's blockade of West Berlin. They took another important stand in the Korean War (1950-1953), after South

Korea had been attacked by Communist-ruled North Korea. Between 1958 and 1962, Russia again applied pressure on the Western powers to withdraw from Berlin, and again failed. In 1962, Soviet Premier Nikita S. Khrushchev tried to gain a sudden military advantage by placing long-range missiles in Cuba. A firm stand by the United States forced him to remove the missiles rather than risk nuclear war.

During the early 1970's, relations between Communist and non-Communist countries appeared to improve. Russia had increased its military strength, and both sides knew how destructive nuclear war would be. This knowledge led to several arms control agreements. In 1972, President Richard M. Nixon visited China. The following year, the United States and China each established a mission in the other's capital. Thus, while the Communist and non-Communist nations remained adversaries, practical policies seemed to be replacing the earlier, more "ideological" ones. See COLD WAR.

Expansion in Southeast Asia. In 1946, the Communist leader Ho Chi Minh led a nationalist uprising in the colony of French Indochina. By 1954, Indochina had been divided into Communist North Vietnam, non-Communist South Vietnam, and neutral Cambodia and Laos.

Communists in Cambodia, Laos, and South Vietnam continued to fight the new non-Communist or neutral governments. North Vietnam sent troops and supplies to help the Communists, and China and Russia also sent supplies. The struggle in South Vietnam developed into a major war. The United States sent troops to support South Vietnam. A cease-fire agreement ended U.S. participation in 1973, but the war continued until the Communists won full control of South Vietnam in 1975. The Communists also conquered Cambodia in 1975. In Laos, the government and the Communists signed a cease-fire in 1973. The two sides set up a coalition government in which Communists held about half the posts. The government came under Communist domination in 1975. See INDOCHINA; VIETNAM WAR.



Wide World

North Vietnamese Communists paraded in Hanoi to celebrate the Communist victory in South Vietnam in 1975. Marchers carried portraits of the Communist leader Ho Chi Minh.

Why Communism? The spread of Communism is usually thought of in terms of force and revolution. However, millions of persons have freely chosen to become Communists or to vote for them.

Communism has different appeals for different individuals and groups. Its main attraction for some is its claim to provide simple answers and solutions in difficult situations. Some persons join the party to avoid being outsiders, and to feel they are part of a meaningful group. Others join to ride the "wave of the future." They believe that Communist victory is inevitable.

The appeals of Communism seem to be strongest in countries where some of the following conditions exist. (1) There are huge differences in income and social position between the poor and the rich, and the poor feel these differences. (2) Communism is the only effective movement fighting for change, reform, or revolution. (3) The existing government does not command the strong loyalty of the people, and its institutions do not stand up well under stress. (4) Many persons feel deprived and discriminated against socially and economically, and as national or racial groups. (5) Communists are not looked on as criminals or lunatics, but as one of several accepted types of revolutionaries.

COMMUNISM TODAY

Since Stalin's death in 1953, no one man or country has been the leader of world Communism. Russia has lost control of the world movement, which has split into a number of separate groups.

At the same time, there has been a growing willingness in Russia and Eastern Europe to depart from standard Communist practices and to experiment with new policies and techniques. Communist doctrine seemed to be losing its importance, especially for young people. There was increasing interest in safe and comfortable living, and less in revolutionary activity. This was not true in parts of Asia and Latin America, where some Communist groups were working for radical change.

The Splintering of World Communism began in the mid-1950's. It was helped by Russia's more permissive attitude toward the Communist countries of Eastern Europe. By the mid-1960's, most of these nations had begun making more and more of their own major decisions, and often ignored Soviet advice. Such independence has been demonstrated by Yugoslavia since 1948, and by Romania from 1962 on.

In 1968, Czechoslovakia defied Soviet warnings and undertook far-reaching reforms under new Communist Party leader Alexander Dubček. These reforms included freedom of the press and tolerance of groups openly critical of Communist policies. But developments that followed indicated that Russia was again setting limits on change and dissent in Eastern Europe. In August, 1968, Soviet, Bulgarian, East German, Hungarian, and Polish troops invaded Czechoslovakia to try to undo the reforms. In April, 1969, Dubček was replaced as party leader. By the early 1970's, Russia had reasserted its leading role in Eastern Europe. Despite continuing tensions, Russia was slowly moving toward its goal of unifying the area economically and militarily.

The most serious challenge to Russia's leadership came from China. The Soviet-Chinese dispute was kept

secret at first. After it burst into the open in the early 1960's, every Communist party had to take sides.

Some of the issues in the quarrel between Russia and China concerned different interpretations of Communist teachings. Nikita S. Khrushchev, premier of Russia from 1958 to 1964, stressed "peaceful coexistence" with non-Communist countries. Khrushchev considered revolution as only one of many methods for spreading Communism. He stressed economic aid and the example of Soviet advancement under Communism.

China accused the Soviet Union of betraying Marxism-Leninism. The Chinese called the Russians cowards for arguing that the threat of nuclear war made large-scale wars unthinkable. The Chinese urged Communists to follow their example and take over through guerrilla-type civil wars. They supported programs of direct action and condemned peaceful coexistence.

In 1960, Russia stopped giving economic and military assistance to China. China and Albania scolded Russia for seeking better relations with the United States. China, Albania, Cuba, North Korea, and North Vietnam refused to sign the nuclear test ban treaty negotiated by Russia and the United States in 1963. China also demanded that Russia return vast territories taken from China more than a century ago. In 1969, China and Russia engaged in a series of armed border clashes. In the early 1970's, China also shifted to a kind of "peaceful coexistence" with the West. But the conflict between Russia and China remained as bitter as ever. More and more, they both acted like rival states instead of fellow Communists.

Today, the unity of world Communism appears to be beyond repair. In each country, the party is adapting Communism to its own needs.

Communism in Non-Communist Countries. Communist parties exist—legally or illegally—in about 90 countries. Their total membership is estimated at 59 million. Of these, fewer than 3 million party members live in non-Communist countries.

In the United States, the Communist Party has little influence. The party was founded in 1919. It may have had as many as 100,000 members during the Great Depression of the 1930's. During the 1930's, some American intellectuals supported the ideals of Communism and believed that the capitalist economy was about to collapse. The party lost many members after World War II because of Soviet policy and the Cold War. Many others left the party after the story of Stalin's crimes was exposed in 1956. In the mid-1970's, party leaders claimed to have 16,000 members in the United States.

Some people argue that party membership is not an accurate measure of Communist strength. Although there no doubt are secret Communist agents and sympathizers in the United States, the danger has often been exaggerated. Most political experts believe Americans should be aware of the dangers of Communism, but that American society has little to fear as long as citizens prize their freedoms and fulfill their civic duties.

In Other Countries. The Communist Party is extremely small in Canada. In most Latin-American countries, Communist organizations are illegal. In others, including Brazil and Mexico, the parties are badly split. Among the Western European nations, Italy, France, and Finland have strong Communist parties. The party is illegal in Spain, but some Communist influence exists. There are few Communist Party members in the African or Middle Eastern nations.

In Asia, the Japanese Communist Party is influential among intellectuals, but has been unable to attract large numbers of voters. The Communist Party of Indonesia had over 2 million members before its leaders supported an attempt in 1965 to take over the government. Thousands of its members were killed after this uprising, and the party was outlawed. In India, Communists are split into rival parties. ALEXANDER DALLIN

Related Articles in WORLD BOOK include:

BIOGRAPHIES

Brezhnev, Leonid I.	Kadar, Janos	Marx, Karl
Castro, Fidel	Khrushchev, Nikita S.	Stalin, Joseph
Engels, Friedrich	Kosygin, Aleksei	Tito
Gomułka, Władysław	Lenin, V. I.	Trotsky, Leon
Hoxha, Enver	Mao Tse-tung	Ulbricht, Walter
Husák, Gustáv		

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Dictator	New Harmony	Totalitarianism
Government	Oneida Community	

Outline

I. Main Features of Communism
- A. The Communist Party
- B. Communism and Government
- C. Communism and the Economy
- D. Economic Change

II. Life Under Communism
- A. Making a Living
- B. Education
- C. Leisure and Culture
- D. Personal Freedom

III. Origins of Communism
- A. Early Communism
- B. Marxism

IV. Communism in Russia
- A. Before 1917
- B. Communism Under Lenin
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V. The Spread of Communism
- A. The Comintern
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- C. The Cold War
- D. Expansion in Southeast Asia
- E. Why Communism?

VI. Communism Today
- A. The Splintering of World Communism
- B. Communism in Non-Communist Countries

Questions

Why is Communism sometimes called totalitarian?
How does socialism differ from Communism?
What did the word *communism* mean originally?
Who were the Bolsheviks? The Mensheviks?
Who planned the Bolshevik Revolution of 1917?
What led to the Soviet-Chinese dispute?
Who wrote the *Communist Manifesto?*
What was the Comintern? The Cominform?
Why do Communists oppose capitalism?
How did the Soviet Union use World War II to advance Communist goals?

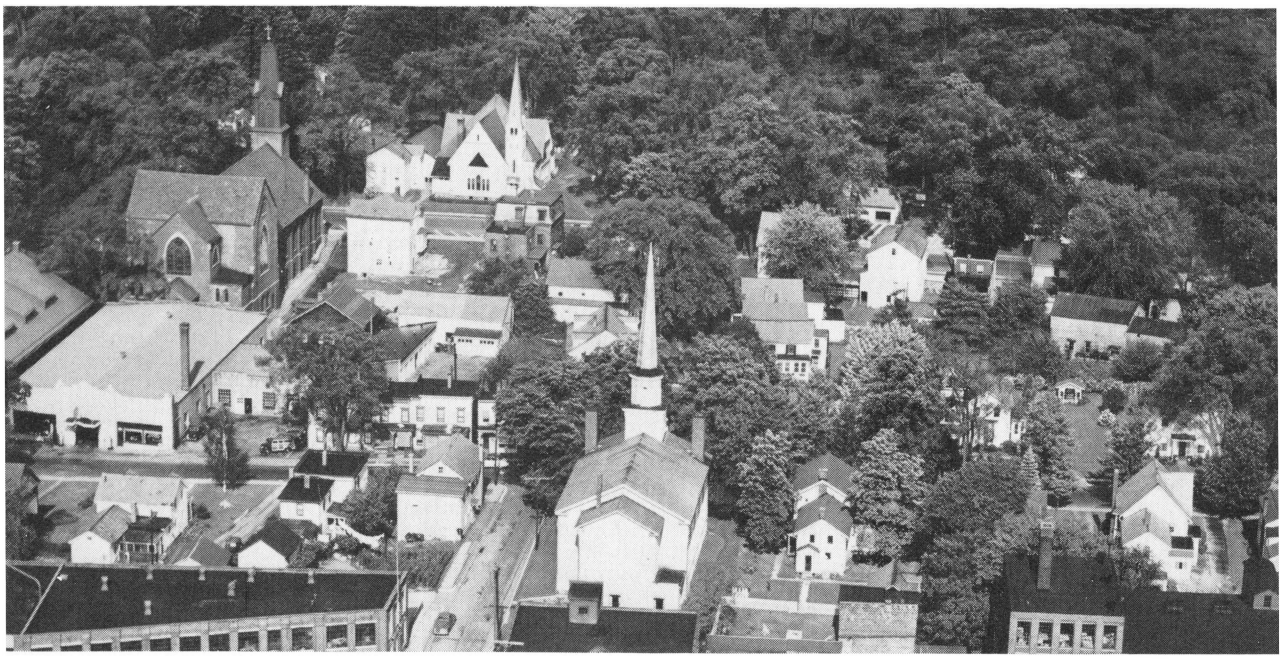
Reading and Study Guide

See *Communism* in the RESEARCH GUIDE/INDEX, Volume 22, for a *Reading and Study Guide.*

COMMUNIST MANIFESTO. See COMMUNISM (Marxism); MARX, KARL.

COMMUNIST PARTY. See COMMUNISM.

COMMUNITY



Standard Oil Co. (N.J.)

A Village Community contains many smaller family, school, and neighborhood communities. It forms a part of many larger and larger communities, linked to them by common interests.

COMMUNITY. Each of us belongs to several communities at the same time. Suppose you examine a letter mailed by someone in another nation to a friend in the United States. It might be addressed like this:

> Mr. John Brown and Family,
> 11 Sutton Place,
> Central City,
> California,
> U.S.A.

Each line of this address identifies one of five different communities to which John Brown belongs. These are (1) the Brown *family* community, (2) the Sutton Place *neighborhood* community, (3) the Central City *local* community, (4) the California *state* community, and (5) the *national* community of the United States.

Each community is a part of the next larger community in the series. And each larger community is made up of the many smaller ones. Several other things are true of all communities. (1) Each community is made up of people who have similar customs and ways of looking at life and who think of themselves as belonging to that community. For example, every member of the Brown family feels that he is a part of the Brown family community. In a similar way, he feels that he belongs to his neighborhood, town, county, state, and nation. (2) The people of each community live in a particular space that can be defined. The Brown family lives in a house at 11 Sutton Place. The people of Central City all live within certain city limits. (3) Each community has created laws or institutions to serve its people. The Brown family has certain rules of behavior, and Central City has its own laws. (4) Each community has a common language, or at least a system whereby its people can communicate with one another. (5) Each community has certain problems that unite its people in a common cause. For example, the people on Sutton Place may be working for a new school, or the people of California for a better state park system.

Expanding Communities

The Family Community. A typical family includes two parents and one or more children. But it might be a childless couple. Or it might consist of several generations living under one roof. Although the family is the smallest community, it is also the oldest and most important. The family must teach children the basic values of life, and begin their education. We depend upon the family for love, affection, and encouragement.

The School Community. For most children, the school is the next expanding community. It is made up of

children from many families, and so is larger than a family community. A school serves a person for only a few years of his life. Because of this, it differs from the other communities to which a person "belongs" throughout his life.

The Neighborhood Community is a group of families who live close together. They deal with each other in face-to-face contacts. They have common problems, and cooperate in various activities.

The Local Community consists of several neighborhoods. It might be a village, including the farm families who depend on the village. Or it might be a group of neighborhoods within a city area.

The County Community is more closely defined than the local community. It is a specific political unit, and provides specific services for its members. These services include those of the county recorder, the county tax collector, the county superintendent of schools, and the county sheriff. The county community also provides many activities through private groups like the county medical association or county grange. In Louisiana, this community is called a *parish.*

The Metropolitan Community includes at least one central city of 50,000 or more persons surrounded by several local communities closely dependent on each other. The people of metropolitan communities have many troublesome problems, such as transportation, water supply, sewage, and law enforcement.

The State or Province Community welds together many smaller communities. It establishes laws and services for a large number of people. The state or province community also has many private agencies, such as state chambers of commerce, state athletic leagues, provincial bar associations, and the like. Most persons take great pride in their state or province, and feel great loyalty to it.

Regions of States or Provinces are less rigidly defined geographically than some other communities. But they are important from the standpoint of the lives and customs of the people. New Englanders, for example, differ in many ways from Southerners or Westerners. The differences may involve social attitudes, economics, politics, and even food. States or provinces within a region must often act as a unit. For example, New Jersey and New York state set up the *Port of New York Authority* to manage the problems of transportation and port facilities in the region around New York City (see PORT OF NEW YORK AUTHORITY). Water-distribution agreements among various Western states are another example of this type of cooperation. THE WORLD BOOK ENCYCLOPEDIA has separate articles on each of the several regions of states in the United States. See UNITED STATES (table: Geographic Regions).

The National Community includes all the smaller communities within its boundaries. Although large and varied, it is one of the most highly organized communities. People identify themselves strongly with their national community. They are citizens of the United States, Canadians, English, Germans, or Russians. The United States consists of 4 regional communities; 50 state communities; thousands of metropolitan, county, and local communities; millions of neighborhood communities; and about 51 million family communities.

International Communities are made up of groups of various national communities.

The Inter-American Community consists of the many nations that make up North, Central, and South America. The Americas have a growing awareness of their common interests, and cooperate through various organizations. See ORGANIZATION OF AMERICAN STATES.

The Atlantic Community includes nations grouped about the Atlantic Ocean and Mediterranean Sea. Wars and trade among the peoples of these areas, and modern technology, have paved the way for ties that bind them increasingly together. After World War II, they joined together for purposes of mutual defense (see NORTH ATLANTIC TREATY ORGANIZATION). Other associations formed by these nations include the European Community and the European Free Trade Association.

The Pacific Community includes lands around the Pacific Ocean—North America, South America, Asia, Australia, and the Pacific Islands. This community covers two thirds of the world's water and land area. On its land live $1\frac{1}{2}$ billion persons who lack a common language and do not as yet have common values or institutions. But modern trade, communications, and transportation are bringing these peoples closer together. SEATO is a move in the direction of a common defense policy (see SOUTHEAST ASIA TREATY ORGANIZATION).

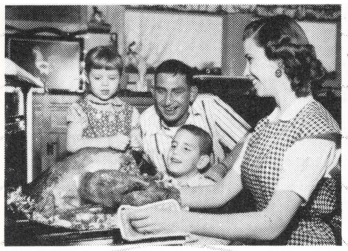
Other International Communities include the Communist Community, the Arab Community, the South American Community, and the African Community. In various ways, the people of these areas fulfill the definition of a community. The Communist Community, for example, is comprised of peoples who to some extent have a sense of belonging, maintain their own types of institutions, and have common problems. See INTERNATIONAL RELATIONS.

The World Community. All the peoples of the earth conform more and more in many ways to the definition of a community. The advances of science and technology have brought wide acceptance of this fact. The United Nations, for example, is a recognition of the emerging community made up of the peoples of the entire world. The Universal Postal Union, the International Bank, the International Court of Justice, and the International Bureau of Weights and Measures are other indications that mankind has begun to think of itself as belonging to an all-inclusive community. See WORLD.

Activities of the Community

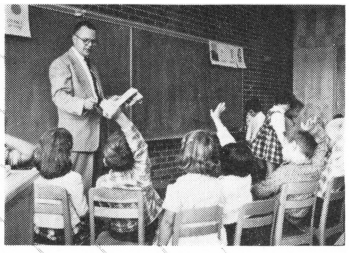
Although communities vary greatly in size and population, they all carry on much the same activities. These activities can be grouped into eight general kinds: (1) protection, (2) trade and industry, (3) transportation, (4) communication, (5) education, (6) recreation, (7) government, and (8) religion and the arts. Let us look at the ways the various expanding communities conduct these activities.

Protection and conservation of health, life, resources, and property are the responsibility of every community. For example, the family community keeps matches away from small children, heats the house, and supplies food. The state or province community provides high-



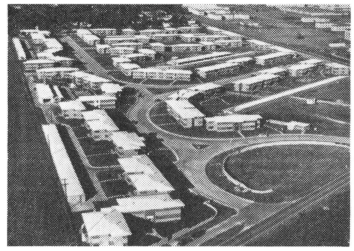
Dorothy McLaughlin, A.P.A.

Family



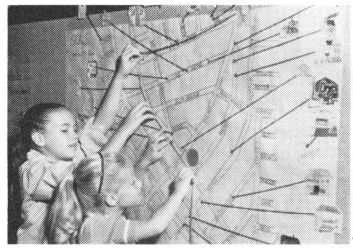
Walter Chandoha

School



Nat'l. Ass'n. of Home Builders

Neighborhood

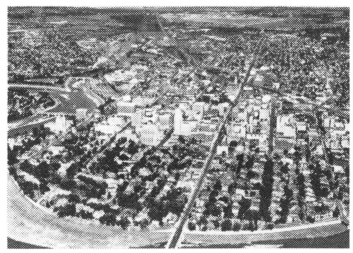


Oakland Public Schools

Local

Soil Conservation Service, USDA

County

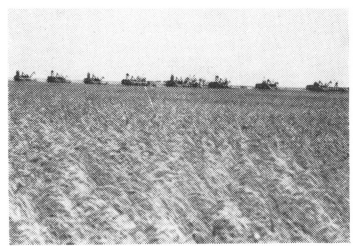


Dayton Chamber of Commerce

Metropolitan

State of Illinois

State or Province



Santa Fe Railroad

Region of States or Provinces

Family

School

Neighborhood

Local

County

Metropolitan

State or Province

Region of States or Provinces

National

International

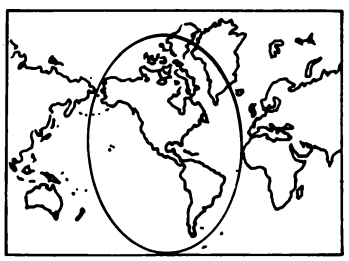
World

Expanding Communities

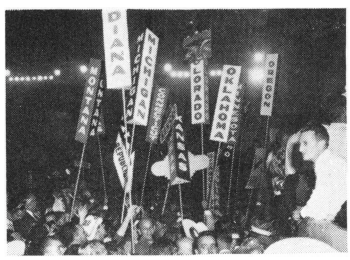
Expanding Communities include all the peoples of the world. Some communities, such as the international community, are quite new, but the family community is as old as mankind.

United Nations

World



International



Chicago Daily News

National

way-safety patrols. State-wide insurance companies offer insurance against loss. The national community maintains an army and navy, and encourages conservation of natural resources. See PROTECTION, with its list of Related Articles.

Industry and Trade form part of the life of every community. The local community may produce milk, poultry, and vegetables. It may manufacture furniture or build its own houses. States and regions of states often specialize in producing certain types of products, and trade them for the products of other states. Every community exchanges goods and services. The neighborhood exchanges baby-sitting services, or perhaps maintains a barbershop or local drugstore. Each community also consumes goods and uses services. See TRADE; INDUSTRY.

Transportation. Communities provide various types of transportation. The school may provide buses to bring children to classes. The state builds highways. The national community provides interstate highway systems and waterways. National airlines and railroads carry people and goods. See TRANSPORTATION.

Communication. The size of the community has expanded with the growth of communication facilities. Primitive communities extended only as far as a man could walk. But today's ideas are exchanged quickly from one part of the world to another. Each community has its own communication system. The family and neighborhood may communicate mainly by word of mouth. A local or national community has newspapers, magazines, radio, and television. See COMMUNICATION.

Education. Schools form only part of the educational effort of communities. The family is the first to teach the young. In the home, a baby learns to talk, walk, and follow directions. The neighborhood provides further education in play groups, the church, and the library. In larger local communities, television and publishing become important educational influences. The national community provides many programs of education in such fields as agriculture, home economics, and military science. The United Nations conducts educational programs on an international scale. See EDUCATION.

Recreation. People today have more leisure time than ever before. They spend much of this time within their family communities. Families participate in such activities as games, household projects, reading, and music. The neighborhood or local community furnishes motion pictures, athletics, concerts, and social events. State and national communities maintain great systems of parks and forests. The Olympic Games provide recreation for the international community. See AMUSEMENTS; RECREATION.

Government. A pupil who helps elect a representative to a student council participates in government within the school community. Every business company, every luncheon club, and every labor union must agree upon rules and regulations. In that sense, they all form some kind of government at their own community level. As a community grows in size, government organization becomes more complicated. A family government may be informal. But a reading of the Constitution of the United States shows how complicated the government of a national community can become. Nations of the world join together to form such governmental organizations as the United Nations and the North Atlantic Treaty Organization.

Religion and the Arts. People in all parts of the world worship in churches, temples, and synagogues. They find pleasure and inspiration at musical concerts and theatrical performances. Families may read aloud together from great literature that expresses or mirrors human ideals and values. Family groups may sing, paint, or dance together. Neighborhood families may gather together to worship. Local communities provide studios and instructors for people who wish to paint, dance, or make music together. Libraries are maintained on local, state, and national levels. Many churches reach across national boundaries into the international community.

Community Improvement

Each of the communities of man changes constantly. Some grow old and weak through these changes. But others become larger, stronger, and more complicated. By studying these changes, a community may be able to guide its growth in such a way that it will be a better place in which to live.

If a man and wife have several children, the size of their family community will grow and they may need a larger house. By studying their budget, and by saving wherever possible, the family may be able to have a bigger home. As the children approach college age, they will need extra money for additional educational expenses. Again, by planning ahead, the family may be able to meet these needs.

Planning is just as necessary for a local community. A growing city needs a larger water supply to provide water for its new homes and factories. So the city government hires experts who predict how much more water will be needed. It hires engineers to design the new water system. Then it consults financial experts who recommend the best way for the city to raise the necessary money. Eventually, by good planning, the city solves the problems caused by its growth.

As the population of a school community increases, it may become necessary for the school district to erect a larger building, buy new equipment, and hire more teachers. School boards everywhere study the growth of their school communities and plan ahead to meet these needs. Sometimes a school district must call for help from the larger community of which it is a part. Perhaps they will need to increase taxes, which are collected by the county community. Or perhaps they must obtain authority for the tax change from the state community.

State communities are becoming more aware of the need for the region of states community to plan solutions to problems that extend over state boundaries. Many state compacts or interstate authorities have been established to study and act on such problems as transportation, water supply, and irrigation. The national community plans ahead to meet its military, recreation, and conservation demands.

Every person should study the needs of each of the various communities to which he belongs. All these communities contribute in some way to his welfare. And each demands certain loyalties and responsibilities

in return. Sometimes these responsibilities seem to conflict with each other. For example, a metropolitan community might need a new highway to solve a serious transportation problem. The best route for this highway may be through your own neighborhood. Your neighbors complain that the new highway will lower property values in the neighborhood community. Which community should you be loyal to—your neighborhood, or your larger metropolitan community? As the complexity of the expanding communities increases, it becomes increasingly important for a person to learn how he can be a good citizen in each and every one of the communities he belongs to. PAUL R. HANNA

Related Articles in WORLD BOOK include:

COMMUNITY LEVELS

City	Megalopolis	Suburb
City Government	Metropolitan Area	Town
County	Nation	Tribe
Family	Province	Village
Local Government	State Government	World

COMMUNITY LIFE AND ACTIVITIES

Art and the Arts	Farm and Farming	Religion
Citizenship	Government	Safety
City Planning	Human Relations	Segregation
Civics	Industry	Service Club
Civil Rights	Juvenile Delinquency	Settlement House
Civilization	Minority Group	Shelter
Club	Playground	Social Security
Communication	Post Office	Trade
Conservation	Public Health	Transportation
Culture	Recreation	United Funds
Education		

COMMUNITY IN HISTORY

Aegean Civilization	Inca
Assyria (The People; Way of Life)	Indian, American
Babylon	Middle Ages (Life of the People; Medieval Towns)
Babylonia (Way of Life)	Persia, Ancient (Way of Life)
Colonial Life in America	Pioneer Life in America
Egypt, Ancient (Family Life; City Life)	Roman Empire (City Life; Country Life)
Feudalism	Western Frontier Life
Greece, Ancient (The People; Family Life)	

Outline

I. Expanding Communities
- A. The Family Community
- B. The School Community
- C. The Neighborhood Community
- D. The Local Community
- E. The County Community
- F. The Metropolitan Community
- G. The State or Province Community
- H. Regions of States or Provinces
- I. The National Community
- J. International Communities
- K. The World Community

II. Activities of the Community
- A. Protection
- B. Industry and Trade
- C. Transportation
- D. Communication
- E. Education
- F. Recreation
- G. Government
- H. Religion and the Arts

III. Community Improvement

Questions

What are the eight basic human activities carried on in most communities?

In what way does the school community conduct each of these activities?

What is the largest community? The smallest?

What characteristics do most communities have in common?

Why does everyone belong to several communities?

How can communities be improved?

How can community life be developed?

How can community leaders be developed?

How do our community responsibilities sometimes seem to conflict with each other?

Why are larger communities growing in importance?

COMMUNITY CHESTS. See UNITED FUNDS.

COMMUNITY COLLEGE. See JUNIOR COLLEGE.

COMMUNITY PROPERTY is the property husbands and wives own together under the laws of eight states—Arizona, California, Idaho, Louisiana, Nevada, New Mexico, Texas, and Washington. The laws differ in detail, but generally consider any property received through the efforts of a husband or his wife as the joint property of both. This does not include gifts and legacies to only one or the other, or property one owned before the marriage. When the husband or wife dies, half the property goes to the survivor. Only the other half of the property can be willed. In case of divorce, most states require the husband and wife to divide their community property evenly. WILLIAM TUCKER DEAN

See also DIVORCE (Divorce Provisions).

COMMUNITY THEATER. See THEATER (Theater in the United States).

COMMUTATION OF SENTENCE. See PARDON.

COMMUTATIVE LAW. See ALGEBRA (Fundamental Laws); SET THEORY (Using Set Theory).

COMMUTATOR. See ELECTRIC GENERATOR (Direct-Current Generators).

COMMUTER. See METROPOLITAN AREA; SUBURB.

COMO, LAKE. See LAKE COMO.

COMORO ISLANDS, *KAHM oh roh*, are a group of small, mountainous islands in the Indian Ocean. They lie in the Mozambique Channel midway between northern Madagascar and the southeastern coast of Africa. The main islands are Grande Comore, Anjouan, Moheli, and Mayotte. Moroni, the capital, lies on Grande Comore. The four main islands cover 838 square miles (2,171 square kilometers), and have a population of 313,000. The islands have a 230-mile (370-kilometer) coastline. Most of the people are Moslems. They produce coffee, cacao, sisal, vanilla, perfume plants, rice, and coconut palms.

France gained control of the Comoro Islands during the 1800's. In 1974, the islanders voted for independence from France. France was expected to grant independence to the Comoros in 1975. HIBBERD V. B. KLINE, JR.

See also MALAGASY REPUBLIC (map).

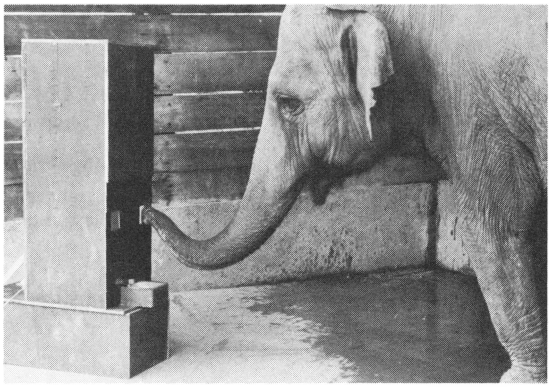
COMPANY. See ARMY, UNITED STATES (table: Army Levels of Command).

COMPANY, in business. See CORPORATION; HOLDING COMPANY; JOINT-STOCK COMPANY; LIMITED COMPANY; PARTNERSHIP.

COMPARATIVE ANATOMY. See ANATOMY; EVOLUTION (Comparative Anatomy).

COMPARATIVE PSYCHOLOGY is the psychology of animals—the study of their intelligence, needs, sensory capacities, and characteristic ways of behaving.

Animals are studied in their natural environments and in such special environments as laboratories and zoos. The natural environment is of particular interest because the animal is equipped to survive there. In the



M. E. Bitterman

A Brightness Discrimination Experiment requires an elephant to choose the brighter of two panels by pressing the panel with its trunk. When the animal makes the correct choice, it is rewarded with peanuts delivered automatically into the food cup.

laboratory, selected features of the environment are varied systematically, and their effects on behavior are measured precisely. Although naturalists sometimes criticize laboratory studies as "artificial," implying that the information obtained is not to be trusted, this criticism is misleading. Some of the most penetrating insights into the behavior of animals have been achieved by making radical changes in their natural environments. For example, rearing a chick in complete isolation shows that social stimuli are necessary for its normal development.

Why Animals Are Studied. Animals are studied because of curiosity about them, and also for practical reasons. Information about the migration and spawning of salmon is not only interesting in itself but also has great economic importance.

Experiments with animals also provide information about man under conditions in which human experiments are not practical. For example, the brains of rats can be stimulated with electrical currents passing through fine wires embedded in the brains by surgery. Experiments of this type have yielded much information about how the brain regulates such basic drives as hunger and thirst. Experiments with rats also have provided valuable information about the psychological effects of drugs.

The results of animal experiments can be applied to man only if it can be assumed that experiments with human beings would yield the same results. Whether they would or not is uncertain. The assumption that they would can sometimes be justified because of (1) the structural resemblances between man and the higher animals, and (2) the similar results of experiments that can be performed with both men and animals.

Methods of Studying Animals. A great deal is learned about men simply by asking them questions, but that method is not available in the study of animals. If the ability of a monkey to detect small differences in brightness is to be determined, the animal first must be trained to respond differently to objects of different brightness. One method is to show the animal a pair of differently illuminated panels, and to reward it with a raisin for pressing the brighter panel. After the monkey has learned to choose the brighter one, the experimenter gradually reduces the difference in brightness between the two panels until wrong choices become as frequent as correct ones. At that point, the limit of the animal's capacity to discriminate has been reached.

Some animals respond differently to certain great differences in stimulation without special training. An octopus is much more likely to attack a moving object than a stationary one. But special training usually is necessary to provide a more detailed picture of sensory capacity.

A kind of information obtained from men by questioning, but which cannot be obtained from animals even by indirect methods, is information about consciousness. The fact that an animal responds differently to two lights of different color does not tell what the colors are for the animal, or whether it experiences color at all. The psychologist does not ask, therefore, what an animal "sees," but only about its ability to discriminate among visual stimuli.

Problems Studied. Any single instance of behavior is the product of several different psychological processes. A monkey's performance in an experiment on brightness discrimination involves more than its ability to detect a difference in brightness. Essential also are an interest in raisins and an ability to learn how to get them in the experimental situation. A comparable experiment could not be performed with a jellyfish, because the jellyfish is incapable of learning. The behavior of such a simple animal is determined entirely by its inherited structure. If that behavior is not appropriate to the environment in which the animal finds itself, the animal simply does not survive.

Comparative psychologists are particularly interested in the ability of animals to learn about their environments and discover new ways of dealing with them. In experiments on classical conditioning, they study the ability of animals to learn about sequences of environmental events. In experiments on instrumental conditioning, they study the ability of animals to learn about the consequences of their actions. See LEARNING (How We Learn).

The intelligence of an animal is closely related to the structure of its brain. Environments change, and some animals adjust more easily than others to these changes. Suppose a rat has been rewarded for pressing the brighter of two panels. If the experimenter then decides to reward the rat for pressing the dimmer panel instead, it will have considerable difficulty learning to press that panel. After the rat has begun to press the dimmer panel, it may have some difficulty shifting back to the brighter panel if the experimenter changes the conditions again. In general, however, the rat accomplishes each shift more easily than the previous one, until it is able to change its behavior almost as soon as the conditions change. A fish, whose brain is much simpler than a rat's, is a less flexible animal. It finds the hundredth change as difficult as the first.

M. E. BITTERMAN

Related Articles in WORLD BOOK include:
Animal (Animal Senses; Intelligence of Animals)
Dominance
Ethology
Mouse (picture)
Psychology [picture]
Space Travel (Steps in the Conquest of Space [pictures])
Territoriality

COMPARISON

COMPARISON, in grammar, is the inflection of some adjectives and adverbs to express a greater or smaller degree of the quality the word denotes. *Inflection* means changing the form of a word. Possessive, demonstrative, and limiting adjectives cannot be compared.

The Three Degrees of Comparison are the positive, comparative, and superlative. The *positive* is the simple degree, as in, "This book is *heavy*"; "This book is *interesting*." The corresponding adverbs, *heavily* and *interestingly*, are also in the positive.

The *comparative* is used when two objects are being compared, as in, "This book is *heavier* (or *less heavy*) than the other," or, "*more interesting* (or *less interesting*) than the other." The corresponding adverbial forms, such as *more heavily* and *less interestingly*, are also in the comparative degree.

The *superlative* is used to point out the one among three or more objects that has the highest or lowest degree of the quality referred to: "This is the *heaviest* (or *least heavy*) book," or "the *most interesting* (or *least interesting*) book." The corresponding adverbial forms, such as *least heavily* and *most interestingly*, are also in the superlative degree. The superlative is also used in the intensive sense of *very*, without implying comparison, as in "That is *most attractive*."

Regularly Compared Adjectives add the suffixes *-er* and *-est* to the positive form, as in *proud, prouder, proudest*. This change is described as *comparison by inflection*. If the adverbs *more, most, less*, or *least* are prefixed, the change is described as a *periphrastic comparison*, as in *proud, more proud, most proud*.

Irregularly Compared Adjectives include some of the most common adjectives in English—words that have come down from Old English, or Anglo-Saxon, forms. The following list contains some irregularly compared adjectives.

Positive	Comparative	Superlative
bad	worse	worst
far	farther	farthest
good, well	better	best
little	less	least
much, many	more	most
near	nearer	nearest, next
old	older	oldest, eldest

Some adjectives and adverbs, such as *perpendicular, square, eternal, unique*, and *perfect* may be considered absolute in meaning and therefore not subject to comparison. If *unique* means "having no equal," how can something be *more unique?* However, phrases like *more perfect, rounder*, and *yellowest* are commonly used. More precise phrases would be *more closely perfect, more nearly round*, and *most intensely yellow*.

Other and *else* are often used to distinguish the elements that are being compared. For example, if Robert's height is being compared with that of the other boys in his class, a precise phrasing would read: "Robert is taller than *any other boy* (or *anybody else*) in his class," not "Robert is taller than *any boy* (or *anybody*) in his class."

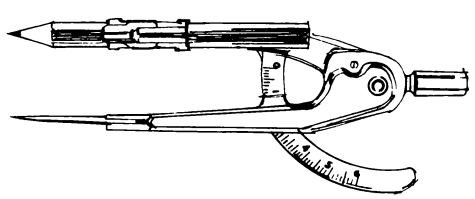
Usage. When two objects are being compared, the comparative form is used, not the superlative. "Helen is the *healthier* of the twins" is correct. "Helen is the *healthiest* of the twins" is wrong.

When comparison is made by inflection, adding an adverb is unnecessary. *Happier* is an adequate comparison. *More happier* is not standard usage. A word like *preferable* means "more desirable." *More preferable* is redundant.

WILLIAM F. IRMSCHER

See also ADJECTIVE; ADVERB; INFLECTION.

COMPASS, or PAIR OF COMPASSES, is a mathematical tool. It consists of two pointed legs that are joined at the top so the legs can be moved closer together or farther apart. A pencil or penpoint may be attached to one leg to draw circles or arcs. Compasses are used to construct geometric figures, such as right triangles and *polygons* (many-sided figures). Compasses also may be used as *dividers*, to measure length or other dimensions.



The Compass Is a Handy Tool used in geometry, and in such occupations as architecture, carpentry, and engineering.

Early Egyptians and Babylonians used the compass, with a ruler, to discover many mathematical principles.

See also GEOMETRY (Constructions).

COMPASS is a device for determining directions. The simplest form of the compass is a magnetic needle that turns. The needle is mounted on a pivot so that it can move freely. It points in the direction of the magnetic north and south poles. A simple pocket compass helps a person find his way when he is lost, and when there are no landmarks to guide him. All he needs to know is the direction in which he should be going. If he must walk west to reach the nearest town, he goes in a direction at right angles to the left of the end of the needle which points north.

Boxing the Compass means naming the 32 points, or directions, marked on the face of a compass. The *cardinal points* are north, east, south, and west. The *intercardinal points* are northeast, southeast, southwest, and northwest. Below is the way a person would "box the compass." The 16 main points are shown in black type.

North	**South**
North by east	South by west
North-northeast	**South-southwest**
Northeast by north	Southwest by south
Northeast	**Southwest**
Northeast by east	Southwest by west
East-northeast	**West-southwest**
East by north	West by south
East	**West**
East by south	West by north
East-southeast	**West-northwest**
Southeast by east	Northwest by west
Southeast	**Northwest**
Southeast by south	Northwest by north
South-southeast	**North-northwest**
South by east	North by west

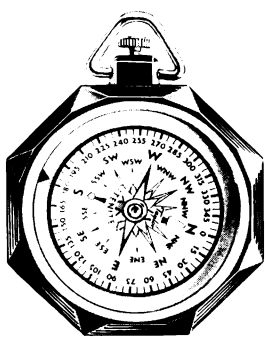
Old-style compasses were marked with the 32 points of the compass. Newer compasses are marked with the 16 main points and with the 360 degrees of a circle. The degree markings are arranged with 0 at north, 90 at east, 180 at south, and 270 at west.

The Mariner's Compass is a large magnetic compass used aboard a boat or ship. It has several magnets fastened on a flat disk, called a *compass card.* This compass card is marked with the points and degrees of direction. The card rests on a pivot so it can turn freely inside the glass-covered compass bowl and can always point toward magnetic north. The compass bowl is filled with a nonfreezable liquid mixture of alcohol and water or glycerin and water. This liquid mixture floats the card and at the same time *damps* (slows) the movement of the card so that it does not constantly swing from side to side with the motion of the ship. A black vertical line, called a *lubber's line,* is marked inside the compass bowl. The compass bowl is mounted so that the lubber's line is toward the bow of the ship. Thus, the compass-card point opposite the lubber's line indicates the direction the ship is heading.

Deviation. The magnetic compass points toward the north magnetic pole. But if it is placed close to a metal object, it will be drawn toward that object. The angle formed between the north magnetic pole and the direction the compass points is called *deviation.*

When a mariner's compass is installed on a ship, it is mounted on a *gimbal* (supporting frame) in a stand called a *binnacle.* The binnacle has magnetic devices that correct major errors of deviation in the compass. After these corrections have been made, the navigator *swings the ship.* That is, he heads the ship in different directions, checking the direction by various landmarks. As he does this, he notes how many degrees of deviation the compass shows from the exact direction of the ship. For instance, by sighting toward a lighthouse on the east, the navigator can tell that the ship is heading exactly east, but his compass may show the ship is heading two degrees south of east. Later, when the ship is out of sight of land, the navigator will know that if he wants to head directly east he should steer a course two degrees south of east on his compass.

Variation. Because the magnetic compass points toward the north magnetic pole, it seldom points toward the true North Pole at the same time. The difference on the compass between the direction of the north magnetic pole and the true North Pole is called *variation* or *declination.* The variation of a compass is different at different places on the earth. The variation also changes at different times of the year and in different years. Therefore, to use a magnetic compass accurately, a person must have a *declination chart,* which shows exactly what variation correction must be made in reading the compass.



Taylor Instrument Companies

A Pocket Compass has a magnetic needle that always points north. A compass card may be attached to the needle. The card shows all other directions in addition to north.

U.S. Navy

A Gyrocompass Repeater picks up information from a gyrocompass below deck. This data is used to keep the ship on course.

History. Chinese and Mediterranean navigators probably first used magnetic compasses to guide their ships in about the 1000's or 1100's. These compasses were simple pieces of magnetic iron, usually floated on straw or cork in a bowl of water. About the 1300's, the compass card was marked off into 32 points of direction. During the following years, navigators learned more about deviation or variation of compasses in various parts of the world, and came to use magnetic compasses with greater accuracy.

When iron and steel vessels appeared in the late 1800's, it became more difficult to make accurate magnetic compass readings aboard a ship. The readings were affected by the metal of the ships. As a result, the gyrocompass was developed. It is not affected by magnetism, and points toward true north. Large ships today carry both magnetic compasses and gyrocompasses. Ordinary magnetic compasses are not satisfactory in aircraft, so various gyroscopic and special magnetic compasses have been developed for use in aviation. Radio has also been used for compasses. After World War II, scientists developed special gyroscopes for compass use in the polar regions. PAUL W. BIGELOW

Related Articles in WORLD BOOK include:
Aircraft Instruments
Direction
Direction Finder
Gyrocompass
Gyrosyn Compass
Loadstone
Magnet and Magnetism
Navigation
North Pole
South Pole
Surveyor's Compass

John H. Gerard

The Yellow Flower Heads of the Compass Plant look like sunflowers. This coarse plant grows 10 feet (3 meters) tall.

COMPASS PLANT is a coarse plant that grows in the Midwestern United States. It reaches a height of 10 feet (3 meters), and is covered with short, rough hairs. The leaves are about 1½ feet (46 centimeters) long and cut into several lobes. The lower leaves of the compass plant tend to line up edgewise in a north-south direction. In this way, the leaves escape the strong midday sun, but get the full early morning and late afternoon sunlight. The compass plant is known as the *pilotweed* in some Midwestern States.

Scientific Classification. The compass plant belongs to the composite family, *Compositae*. It is genus *Silphium*, species *S. laciniatum*. JULIAN A. STEYERMARK

COMPENSATION. See DAMAGES; UNEMPLOYMENT INSURANCE; WAGES AND HOURS; WORKMEN'S COMPENSATION.

COMPETITION, in economics. See MONOPOLY AND COMPETITION.

COMPLEMENT, in set theory. See SET THEORY (Operations with Sets).

COMPLEMENTARY COLOR. See COLOR (Color in Paint; Color in Light).

COMPLEX. See MENTAL ILLNESS (Terms; Kinds); OEDIPUS COMPLEX.

COMPOSER is a person who invents musical ideas and writes them down for others to perform. The composer is often distinguished from the improviser, who invents as he plays. Composers of popular songs and dance music are usually called *songwriters*.

Composers must study many different fields of music, such as harmony, counterpoint, form, and orchestration, in order to gain experience and develop an ear for music. They often perform, conduct, or improvise while studying. But they learn most by studying other composers' scores, and through personal experience in writing music. Many composers plan musical ideas as a painter sketches a picture. Ludwig van Beethoven's notebooks show that his ideas developed and improved in this way.

Composers are the most creative of musicians, and have introduced many new techniques and styles. Composers historically important as innovators include Beethoven, Claudio Monteverdi, Joseph Haydn, Richard Wagner, Igor Stravinsky, and Arnold Schönberg. They developed new ideas that shaped the progress of music. Other composers consolidated earlier established methods, and are recognized as masters of a particular style or period. Such composers include Giovanni Palestrina, Johann Sebastian Bach, Wolfgang Amadeus Mozart, and Johannes Brahms.

Early composers usually performed their own music. Since about 1850, however, composers have specialized more, major works have grown longer, and music has become more complex. For these reasons, composers seldom perform their own music in public, but rather have it played by specially trained performers. Another reason is that modern audiences and performers show more interest in music of earlier times. When music was composed for immediate use and performers sought new scores for their audiences, the competent composer was highly respected. But, for the last 100 years, living composers have found it difficult to gain recognition for their serious works. Mechanical reproductions of music have created a large audience, but mostly for light music.

The adventurous composer who introduces new ideas into serious music has always had difficulty in gaining acceptance. His greatest works usually become popular only after his death. Sometimes 50 years may pass before such a composer attains recognition. GRANT FLETCHER

See also the list of biographies of composers in the Related Articles in the MUSIC article.

COMPOSERS, AUTHORS AND PUBLISHERS. See AMERICAN SOCIETY OF COMPOSERS, AUTHORS AND PUBLISHERS.

COMPOSITE FAMILY, *kum PAHZ it*, also called COMPOSITAE, is the largest and the most highly developed family of flowering plants. It consists of more than 20,000 *species* (kinds) of herbs and shrubs. Composite plants have efficient methods of reproduction. They can produce many seeds, and have good methods of scattering them.

Each flower head is a composite of many small flowers. The heads are usually made up of two kinds of flowers, the *ray* and the *disk* flowers. In the sunflower, for example, ray flowers form the yellow outer fringe of the flower head. Disk, or tubular, flowers make up the inner brown disk. The seed coverings of composite plants vary greatly. The seeds of the thistle and dandelion are tipped with feathery hairs and are carried by the wind. Other seeds have bristles, scales, or barbs, and are carried on the fur of animals.

Only a few composite plants, including endive, chicory, lettuce, and artichoke, are used as food for man. Some, such as calendula, camomile, wormwood, tansy, and arnica, are used to make drugs. Chrysanthemums, asters, and dahlias are grown for their beauty. Weeds and wild flowers of the composite family include

ragweeds, goldenrod, sagebrush, thistles, and burdock.

Many flowers of the composite family have separate articles in WORLD BOOK. For a list of these flowers, see FLOWER (table, Families [Composite]).

Scientific Classification. The composite family is in the order *Campanulales*. Some classifications divide it into several families. GEORGE H. M. LAWRENCE

COMPOSITION is the expression of organized thoughts in writing. Oral composition is the expression of organized thoughts in speech. A prime method for both writing and speaking well is to strive first to speak well and then to write as you speak.

Composition of written reports or letters is one of the most important tasks in modern life. Aside from its use in business, composition is important in school, as well as in club activities, discussion groups, and similar activities of community life.

A clear, concise letter will bring a reply sooner than a "gabby" letter. Business letters deserve special attention, because there is no assurance that there will be even one interested reader. Good ones may open up limitless business opportunities for the writer.

Preparing a Composition

Choosing a Subject is difficult for some persons. Boys and girls often complain that they have nothing to speak or write about. Yet whenever two or three are in a group, tongues wag and ears open. Boys and girls also hold lengthy telephone conversations or write pages and pages of letters to friends. Their natural desire to share knowledge, ideas, and opinions with others merely needs improvement.

To write a composition, you must know what you are trying to say. Limit your topic. Don't try to solve all the problems of the universe on one sheet of paper. Don't describe all your pets or all your friends. You need not describe an entire storm to tell how you were drenched on the way home from school.

Sources. Much of what you write can come from your own knowledge and experiences. When you need more information, the encyclopedia is a good starting point. But you must often go to specialized books or to other people for specific information. You may take notes on the material in other sources. But if you copy directly, be sure to use quotation marks to indicate that these are not your own words, but the words of some other writer.

Outlining is important to the finished composition. Try to express in one sentence exactly what you hope to accomplish in your composition. Decide where and how you are going to end your composition before you begin. Select a starting point and move directly from that to the chosen ending. The route should be a straight one. The first event is followed by the second, or the cause leads directly to the result or effect. A fact may be traced backwards to its cause. A number of circumstances may be related by starting with the least important one you want to tell about, and working up to the most important.

Put the plan on paper before starting the composition. Jot ideas down as they pass through your mind. Then arrange them in the proper order and change, cross out, or add words. Make sure that you have included all the necessary steps so that your reader will understand the subject as clearly after reading your composition as you do while writing it. Take out facts which have no relation or are loosely connected with the topic in mind. This makes for *unity*. The finished outline must hold together. This quality in any kind of a composition is called *coherence*. The plan need not be long.

Writing the composition is simpler with the outline before you. It eliminates much of the confusion over what to say and when to say it.

Writing a Composition

Effective Sentences. Make every sentence proceed naturally from the one which it follows. There should be no contradictions, no "backwater" remarks, such as: "When I saw him I was frightened; at least I felt shy." Avoid many connecting words that add little to the meaning. "The title of this book is *Tom Sawyer*. It was written by Mark Twain. It is about the Mississippi Valley" can become "*Tom Sawyer* by Mark Twain takes readers to the Mississippi Valley"—11 words instead of 20. Your sentences should bring interesting facts close together and not "string them out."

At every point you should know exactly where you are in all your material so that your readers and listeners will also know. Use such expressions as *next*, *afterwards*, *likewise*, *unexpectedly*, *as a result*, *meanwhile*, *moreover*, *however*, and *on the other hand* to show relations of sentences and ideas. Make your concluding sentence a carefully worded and exact one.

Expressive Words. Use words that express precisely what you intend to say. Avoid such indefinite expressions as "She had a *peculiar* kind of red dress on." What made it peculiar? Beware of exaggeration. Did the high waters sweep *everything* away? How many objects? Name some. The word to use is the word which most closely expresses the meaning or feeling intended. Sometimes the strongest word you can think of to express your meaning is the shortest one.

Do not be content with any word which does not exactly fit your need. Ask other persons. Look in books. Read the dictionary entry for the word that does not satisfy you; you may find a hint of the word you need. Use concrete and colorful words as much as you can. But beware of using words which seem out of place with the topic and the intention of your composition.

Correct Usage. A writer is not understood unless he follows the rules of spelling, capitalization, and punctuation. Every new topic means a new paragraph. The first line of the paragraph begins to the right of the regular margin to show a new section is beginning.

Testing. One of the most important tests of a good composition is in the fulfillment of the theme. Before starting to work, know what you want to accomplish in the composition. This is your *theme*. After the composition is completed, read it and then ask yourself, "Did I accomplish what I set out to do?" J. N. HOOK

Related Articles in WORLD BOOK include:

Alliteration	Hyperbole	Paragraph
Antonym	Irony	Punctuation
Capitalization	Language	Simile
Figure of Speech	Letter Writing	Spelling
Grammar	Onomatopoeia	Synonym
Heteronym	Outlines and Outlining	Vocabulary
Homonym		Writing (career)

COMPOSITION, in the arts, has a number of special meanings. In music, it means either the act of putting notes or sounds together to form a piece, or the completed work itself. In the graphic arts, composition means setting type, either by hand or by machine. In painting and the other visual arts, composition means putting together lines, shapes, colors, light and dark areas, patterns, textures, and other elements. There are two basic approaches to composition in the visual arts—*spatial* (composition in space) and *pictorial* (composition in the work as a whole).

Spatial Composition is a way of giving depth and solidity to a work of art. A sculptor works in three dimensions—height, width, and depth—but a painter has only the flat surface of his canvas to work with. If he wants to give the impression of depth in his landscape, he must use visual tricks such as perspective to gain the effect he wants. He makes the distant objects in his scene smaller and more blurred than the objects in the foreground. He uses brighter colors and sharper lines for near objects, and duller colors in the background. He arranges the lines and planes so they seem to lead backwards toward the horizon. See PERSPECTIVE.

Pictorial Composition is a way of keeping all the elements in a painting from falling apart. If a painter is too skillful in this use of spatial composition, his work may seem more like a real scene outside a window than it will like what it is—a three-dimensional scene in two dimensions. Or, if he uses a bold pattern and emphasizes strong, bright colors, his work may seem more like the design for fabrics or wallpaper than it will like a painting. By using all elements of painting, and not just a few, a painter can create a valuable work of art.

Two of the most important modes of composition are *representation* and *design*. We often think of a painting as only a picture of something, a representation of an object or emotion. Painters often think of their works only in terms of design—balance and contrast, rhythm and repetition (see DESIGN). Many great paintings strike a balance between representation and design. They give us a picture of something we can recognize, unified and given added meaning by a rich, complex design. But not all painters have been interested in both representation and design, and most painters have been more interested in one mode than another.

See also PAINTING (What Do Painters Paint?).

COMPOSITION OF FORCES. See FORCE.

COMPOST, *KAHM post*, is a mixture of soil and partly decayed plants. It may also include commercial fertilizer and manure. Compost is used to make garden soils more fertile and improve production. It may also be spread around plants as a mulch (see MULCH).

Coffee grounds, garden-plant clippings, grass clippings, leaves, including the outer leaves of vegetables, and manure are good materials for compost. Spread them in a layer about 6 inches (15 centimeters) deep and sprinkle this with commercial fertilizer. Cover the layer with about 1 inch (2.5 centimeters) of soil and start a new layer of compost. Water the mixture frequently to speed decay. Allow the compost to decay for about 6 months before using it. WILLIAM RAYMOND KAYS

COMPOUND is a chemical combination of two or more elements. The different elements join to form compounds in much the same way that letters of the alphabet may be linked to form words. Hundreds of thousands of possible compounds can be formed from the 103 elements. The atoms of these elements combine to form molecules of a new substance, the compound. Many compounds occur in nature. Others are man-made.

The properties and appearance of a compound are usually quite different from those of the elements it contains. For example, the element sodium (Na) is a soft, shiny metal that reacts violently with water and many other substances. Another element, chlorine (Cl), is a greenish, poisonous gas. But when these two elements are combined in the proper proportions, the result is the compound sodium chloride (NaCl), or common table salt. In the same way, two gaseous elements, hydrogen and oxygen, make up water, H_2O. Sugar, $C_{12}H_{22}O_{11}$, is a white, sweet-tasting solid. But it consists of carbon, a black, tasteless solid, and hydrogen and oxygen, two colorless, odorless, tasteless gases.

A compound has a definite, unchanging composition. Water contains two atoms of hydrogen to each atom of oxygen, and it always consists of 11.19 per cent hydrogen and 88.81 per cent oxygen by weight. Pure sugar, or sucrose, always contains 42.11 per cent carbon, 6.48 per cent hydrogen, and 51.41 per cent oxygen.

A compound should not be confused with a mixture. A compound always has the same composition by weight, and its atoms are always arranged in a definite manner. A mixture, on the other hand, can be made from varying proportions of substances. Also, a compound is formed by chemical reaction, whereas a mixture is not.

When a compound is prepared, a chemical reaction always takes place. Heat, light, or electrical energy may either be used up or produced. For example, sunlight supplies the energy by which sugar or starch is made in the photosynthesis of plants. But hydrogen and oxygen combine with explosive violence to form water. Chemical reactions also occur when a compound is broken down into its original elements.

Chemists prepare some compounds by direct union of the elements. However, they usually make the desired compound from other compounds. This sometimes involves complex chemical reactions. Thousands of useful compounds are made from the hydrocarbon compounds present in petroleum and natural gas. JAMES S. FRITZ

Related Articles. See CHEMISTRY with its list of Related Articles on specific chemical compounds. See also:

Acid	Element, Chemical	Molecule
Atom	Homolog	Radical
Base	Isomers	Salt, Chemical

COMPOUND EYE is an eye that consists of many units. Insects and crustaceans have compound eyes. See also ANT (Head); BEE (Eyes); CRUSTACEAN; EYE (Animals Without Backbones); INSECT (Senses).

COMPOUND MOTOR. See ELECTRIC MOTOR (Kinds; picture: Types of Electric Motors).

COMPRESS. See BANDAGE.

COMPRESSED AIR. See AIR (Air Compression); PNEUMATIC TOOL.

COMPRESSION. See GASOLINE ENGINE (High and Low Compression); HEAT (Friction).

COMPRESSIVE STRENGTH. See STRENGTH OF MATERIALS.

COMPRESSOR. See PUMP; JET PROPULSION (Turbojet); SUPERCHARGER; WIND TUNNEL.

COMPROMISE OF 1850 was a series of acts passed in 1850, by which the United States Congress hoped to settle the strife between opponents of slavery in the North and slaveowners of the South. These laws helped delay civil war for about 10 years.

The main problem was whether the territory the United States received as a result of the Mexican War should have slavery. To satisfy the South, the Compromise gave Texas $10 million to abandon its claims to New Mexican territory, and to set up a stricter federal law for the return of runaway slaves. To please the North, the slave trade was abolished in the District of Columbia, and California entered the Union without slavery. The territories of New Mexico and Utah were organized, but the slavery question was left to each of them to settle.

Daniel Webster, Henry Clay, and Stephen A. Douglas led in winning the passage of the Compromise laws. John C. Calhoun led the opposition. For a few years, the Compromise seemed to have ended the friction. Businessmen wanted peace so prosperity would continue. But many northerners thought the Fugitive Slave Law was too harsh, and some states interfered with its enforcement. Many slaves escaped to Canada by the *underground railroad.* Slavery did not become a major issue again until Congress passed the Kansas-Nebraska Act of 1854, making slavery legal in territories where it had been prohibited. JOHN DONALD HICKS

See also FUGITIVE SLAVE LAW; KANSAS-NEBRASKA ACT; OMNIBUS BILL; UNDERGROUND RAILROAD.

COMPTON, Calif. (pop. 78,547), is an industrial city midway between Los Angeles and Long Beach (see CALIFORNIA [political map]). Compton has over 160 manufacturing plants. Its chief products include aircraft parts, oil-drilling tools, pipe, aluminum castings, heaters, structural steel, coffee, and roofing materials. A railroad freight line and an airport serve the city. Compton has three county libraries and a civic symphony orchestra.

A group of miners, unsuccessful in the California gold rush, founded Compton in 1867. One founder was Griffith Dickinson Compton. The city was rebuilt after an earthquake destroyed it in 1933. Compton has a council-manager form of government. GEORGE SHAFTEL

COMPTON is the family name of two brothers who made important contributions to atomic science.

Karl Taylor Compton (1887-1954) made many discoveries in the field of electrical discharge in gases. He was also an administrator and a director of scientific research. He was chairman of the board that evaluated the Bikini atomic bomb tests in 1946. In 1948, Compton became head of the Research and Development Board of the National Military Establishment, which reported on countermeasures against the atomic bomb. President Harry S. Truman named him to the National Security Training Commission in 1951.

Compton was born in Wooster, Ohio, and was graduated from the College of Wooster. He taught physics and, from 1915 to 1930, headed a group of research workers in atomic physics at Princeton University. He served as president of the Massachusetts Institute of Technology from 1930 to 1948.

Arthur Holly Compton (1892-1962) headed one of the groups that produced the atomic bomb, and made important discoveries in the fields of X rays and cosmic rays. He shared the 1927 Nobel physics prize for one of his discoveries, called the *Compton effect.* His experiments with the scattering of X rays showed that these rays may behave as particles. These experiments helped to prove the quantum theory.

Compton was born in Wooster, Ohio, and was graduated from the College of Wooster. He taught physics at Washington University from 1920 to 1923 and at the University of Chicago from 1923 to 1929. He served as chancellor of Washington University from 1945 to 1953. In 1956, Compton published *Atomic Quest: A Personal Narrative,* which is an account of the World War II plutonium project. RALPH E. LAPP

See also ATOMIC BOMB; COSMIC RAYS; PLUTONIUM; QUANTUM MECHANICS; X RAYS.

COMPTON-BURNETT, DAME IVY (1892-1969), an English novelist, ranks among the most accomplished literary stylists of her time. In achieving style, she largely ignored description, plot, and exciting action. Instead, she used highly polished dialogue to reveal the essential nature and inner thoughts of her characters. All her characters speak brilliantly—whether they are adults or children, masters or servants. Many of her books center around intricate family relationships. They are all set in the late Victorian upper-class atmosphere in which Miss Compton-Burnett was raised. Her novels include *Bullivant and the Lambs* (1948), *Mother and Son* (1955), and *The Mighty and Their Fall* (1962). Miss Compton-Burnett was born in London. She was made a Dame Commander in the Order of the British Empire in 1967. JOHN ESPEY

COMPTON EFFECT. See COMPTON (Arthur H.).

COMPTROLLER. See BANKS AND BANKING (Terms).

COMPTROLLER GENERAL OF THE UNITED STATES is one of the most important financial officers of the government. He has control and direction of the General Accounting Office, a legislative agency that checks on government spending for the Congress.

The comptroller general rules on the legality of the use of federal funds and settles claims for and against the government. His decisions are usually final, but may be reviewed by Congress or the Supreme Court.

The President appoints the comptroller general to a 15-year term. He cannot be reappointed, and only Congress can remove him from office.

Critically reviewed by the GENERAL ACCOUNTING OFFICE

See also GENERAL ACCOUNTING OFFICE.

COMPTROLLER OF THE CURRENCY is the United States government official who oversees the operations of the more than 4,800 national and District of Columbia banks. He and his staff make sure national bank laws are obeyed. They also inform the public of regulations governing bank operations. The comptroller approves all new national banks, their consolidations, and their branches. National bank examiners on his staff regularly examine the banks to determine whether they are in sound financial condition.

The comptroller's office is part of the Department of the Treasury. It was created in 1863 by the act that established the national banking system.

Critically reviewed by the OFFICE OF COMPTROLLER OF THE CURRENCY

COMPULSION. See PSYCHIATRY (Neuroses).

COMPULSORY MILITARY TRAINING. See MILITARY TRAINING.

International Business Machines Corp.

Computers by the Dozen fill the testing center of a computer manufacturer. Here, specialists test new *programs* (sets of instructions) which computers follow when solving problems.

COMPUTER

COMPUTER is a machine that handles information with amazing speed. It works with such information as names and addresses, book titles, lists of items sold in stores, mathematical problems, and weather forecasts. A computer handles information in the form of numbers. It solves problems dealing with words by changing them into problems dealing with numbers. The fastest computers can do millions of problems in a few seconds.

Businessmen use computers for bookkeeping and accounting. A computer keeps track of sales, customer payments, and the amount of stock in warehouses. It figures out employees' wages and prints their paychecks. Many banks have computers to record the amount of money deposited or withdrawn by each customer. Engineers use computers to check the design of buildings, bridges, and dams. Astronauts use computers to keep their spaceships on course. Computers make the connections between telephones in some areas.

Because of the widespread use of computers, the computer industry has become one of the largest industries in the United States. The computer industry consists of companies that manufacture, sell, and *lease* (rent) computers. It also includes companies that supply various products and services used by specialists who work with computers.

In some industries, computers control machines that make products. A computer turns the machines on and off, and adjusts their operation when necessary. Machinery controlled by computers is used in making bakery goods, chemicals, steel products, paper, and many other items. Computers also set type for printing newspapers and books. For more information on the use of computers in industry, see the article on AUTOMATION in WORLD BOOK.

Computers have been called "electronic brains." But a computer cannot think. A human operator must put *data* (facts and figures) into a computer. Then he must tell the computer what to do with the information.

Special machines are used to put information and instructions into a computer. One of the most important of these machines is similar to a tape recorder. It records information in the form of tiny magnetic spots on a plastic tape. This machine "reads" the tape and sends the information to the computer in the form of electric signals. A piece of magnetic tape about 1 inch (2.5 centimeters) long could hold the names, addresses, and telephone numbers of 15 persons.

A computer has a *memory* that stores information, and an *arithmetic* (pronounced *AR ith MEHT ick*) *unit* which performs mathematical operations. These parts contain most of the electronic equipment that makes the computer work. A computer is connected electrically with tape machines, automatic typewriters, and printing machines that record the information it produces.

A computer operator sits at a desklike unit called a *console*. On parts of the console are tiny lights that flash when the computer is operating. These lights tell what operation the computer is performing at any moment. A computer works noiselessly most of the time. But when the high-speed printing machines operate, they sound almost like machine guns. Some of these printers can print enough information in one minute to fill four pages of a telephone directory.

A computer that does many kinds of jobs may include enough equipment to fill a room, or it may be as small as a table radio. The small computers that do many jobs are often called *minicomputers*. Other kinds of small computers are designed to do only one job, such as guiding a spacecraft.

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Computers may be classified according to the jobs they can do. A *general purpose computer* can perform many kinds of jobs. General purpose computers may be used in banks, department stores, libraries, or schools. A *special purpose computer* is designed for just one job, such as helping to guide a space vehicle.

Computers also may be classified into two types according to the way they work. These types are: (1) *digital computers* and (2) *analog computers*. Each type operates in a different way. The operation of these computers is explained in the following two sections.

Digital Computers solve problems by counting *digits* (numbers). These machines can add, subtract, multiply, and divide. Electronic digital computers differ from adding machines and other ordinary figuring machines because they can automatically do many problems, one after the other. For example, a computer may first add two numbers, then subtract a third number from the sum of the first two, and finally multiply the result by a fourth number—all in one continuous operation. A digital computer also can compare two numbers to find if both are equal or if one is larger than the other.

Before a digital computer can solve any problem, it must be given two kinds of information. First, it must have all the numbers to be used in solving the problem. Second, the computer must have a set of instructions, called a *program*, that tell it what to do with the numbers. The numbers and the instructions are stored in the memory of the computer.

A human operator puts the necessary numbers and the program into the computer. The machine then performs a series of operations with the numbers, according to the instructions of the program.

Most digital computers are general purpose computers. Manufacturers produce a variety of standard models, each of which can do many basic jobs in almost any business or industry. These computers are so widely used that the word *computer*, when used alone, usually means a general purpose, digital computer.

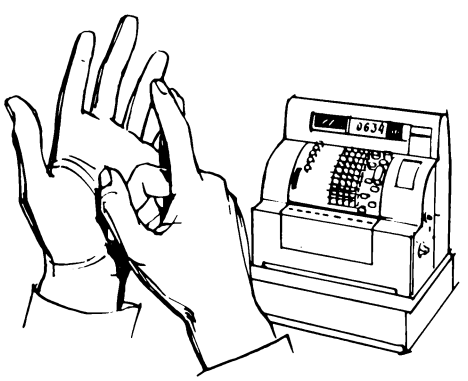
The rest of this article, except for the following section on analog computers, describes the parts and operation of general purpose, digital computers.

Analog Computers solve problems by measuring one quantity in terms of some other quantity. Most well-known instruments operate on this principle. For example, a thermometer measures temperature in terms of the length of a thin line of liquid in a glass tube. The longer the line, the higher the temperature. An automobile speedometer measures speed by means of a pointer moving across a dial. The faster the car is going, the farther the pointer moves. An analog computer might use electrical hookups to represent the speed and direction of an airplane, and to measure the effect of wind on the plane. The computer's electrical hookups act as an *analogy* (likeness) of the flying airplane. The analogy gives an analog computer its name.

Crewmen learning to pilot airplanes or spacecraft are trained in machines controlled by analog computers. Guided by a computer, a training machine duplicates situations that might occur on a real flight.

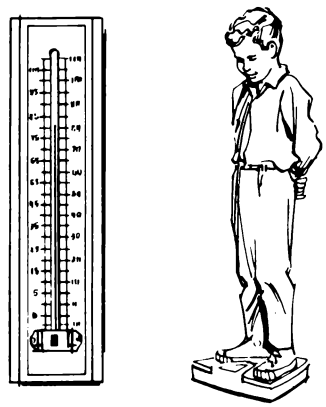
Quantities such as electrical voltage cannot be measured exactly. As a result, analog computers are not so exact as digital computers, which work with numbers digit by digit. Most analog computers are special purpose computers. They may solve their special problems faster than a digital computer could.

SIMPLE DIGITAL COMPUTERS



Digital computers solve problems by counting, just as a person does when he counts on his fingers. A cash register is a mechanical digital computer. It contains wheels that turn to certain positions to represent numbers. The register adds by counting the turns that the wheels make.

SIMPLE ANALOG COMPUTERS



Analog computers measure one quantity in terms of another quantity. A thermometer indicates temperature in terms of the length of a thin line of liquid. The line gets longer as the temperature rises. A bathroom scale indicates weight by the distance a dial moves.

A general purpose, digital computer consists of five main parts. Each part does a special job. (1) *Input equipment* sends data and instructions into the memory. (2) The *memory* stores data and instructions until they are needed. (3) The *control unit* gets instructions from the memory and tells the arithmetic unit what to do with the data. (4) The *arithmetic unit* gets data from the memory and performs the operations ordered by the control unit. (5) *Output equipment* records the desired information and delivers it from the computer.

The memory, control, and arithmetic units may be grouped in a single unit called the *central processing unit* (CPU). Input equipment and output equipment, often referred to as *peripheral* equipment, may be connected with a CPU or work independently of it. When connected with a CPU, peripheral equipment is said to be *on-line*. When working independently, it is *off-line*. Cables or telephone wires may connect a CPU in one city with peripheral equipment located in another city. Such peripheral equipment provides *remote terminals* for the CPU.

Certain types of peripheral equipment called *auxiliary storage units* function as both input and output devices. An auxiliary storage unit can store more data and instructions than the memory unit of a CPU.

Input Equipment works with punched cards, magnetic tape, magnetic disks or drums, and other kinds of records that contain data and instructions.

Punched cards carry information in the form of patterns of holes. Operators put the holes in the cards with *key punch* machines similar to typewriters. A common type of card has room for holes that represent 80 letters or numbers and other symbols.

Machines called *card readers* take information from the punched cards. These machines can "read" more than a thousand cards a minute. They put the information from each card into the form of electric signals. The signals are sent to the computer's memory. Then they are usually recorded on magnetic tape for storage.

Magnetic tape used in computers is similar to that used in tape recorders. Computer tape carries information in the form of small magnetic spots. Spots representing more than a thousand letters and numbers can be recorded on 1 inch (2.5 centimeters) of tape. Machines called *tape units* put data and instructions on the tape. These machines get the information from punched cards and other input records. Tape units also are used to read information from magnetic tape and send it into the memory.

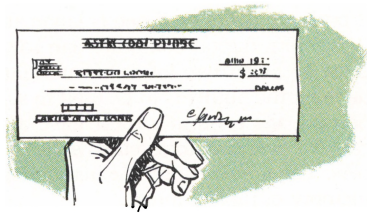
Magnetic disks or drums store information as magnetic spots on a metal surface. A disk storage unit holds a stack of shiny metal disks, called a *disk pack*. A drum storage unit contains a cylinder-shaped drum. Disk or drum machines can find stored information faster than a magnetic tape unit can. A tape machine must read through a whole reel of tape to find information stored near the end of the tape. To find a particular piece of information, a disk machine needs to read only one disk from the pack. A drum machine can move quickly to any spot on the drum without having to read all the information on the drum.

Tape units and disk machines use tape reels or disk packs that can be removed and replaced. Thus, information put on these units can be stored apart from the computer for future use. An operator cannot remove the drum from a drum machine. Therefore, if he wants to save information already on the drum, he must first transfer the data to a tape or disk.

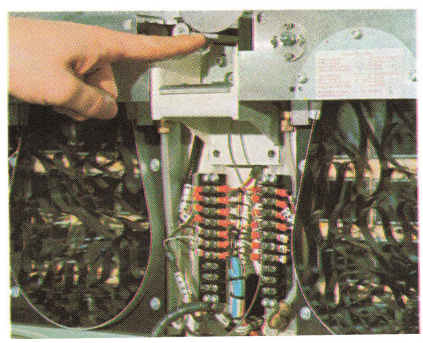
A device called a *data entry machine* records information on magnetic disks or tapes. An operator uses the device in much the same way as a key punch machine.

Other kinds of input equipment handle information that has been stored in various other ways. *Paper tape* equipment reads

Operator's Console, *above,* **keeps track of the basic operations performed by the computer equipment shown on these pages.**



Input. *Just as a bookkeeper reads a check, above, to put information into his head, a tape unit, below, reads magnetic tape to put information into a computer. The bottom photo shows the part of the machine that reads the tape.*

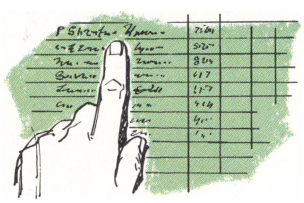


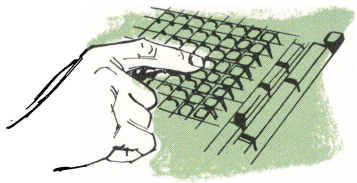
information stored as a pattern of holes in a roll of paper tape. An *optical scanner* works somewhat like the human eye. The scanner "looks" at handwritten or printed information and produces electronic signals that represent the information. Some equipment uses a process called *magnetic ink character recognition* to read data printed with special ink. The ink contains a metal powder that can be magnetized and then read by the equipment. Telephones with *Touch-Tone* buttons also may be connected to a computer. By pressing the buttons, a person can put information into the computer.

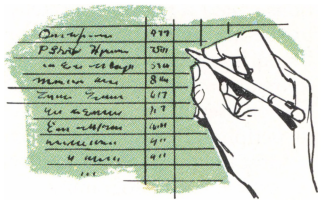
Memory receives information from input machines and holds it until needed by other parts of the computer. One kind of memory consists mainly of thousands of small rings called *cores*. Each core can be magnetized in either a clockwise or counterclockwise direction. When magnetized one way, a core stands for a 1. When magnetized the opposite way, it stands for a 0. The memory "remembers" any number by magnetizing a group of cores in a certain combination of 1's and 0's. This method of using 1's and 0's to represent any number is called the *binary numeration system* (see NUMERATION SYSTEMS [The Binary System]). The memory also remembers words by substituting numbers for letters.

A single memory core can store one *binary digit* (a 1 or a 0), also called a *bit*. Many cores are needed to represent most numbers or words. The memory is divided into sections with a certain number of cores. A number called an *address* identifies each section so that the computer can find stored information when it is needed.

Control Unit guides the computer in performing operations with stored data. This unit selects *instructions* from the memory. An instruction consists of a series of numbers. It includes a code number that tells what operation is to be performed, such as addition or subtraction. The instruction also includes addresses that tell where data for the operation are stored in the memory. After the control unit selects an instruction, it commands the arithmetic unit to perform the proper operation. Then it selects another instruction and gives the arithmetic unit another command. The control unit repeats these operations until the job is finished.





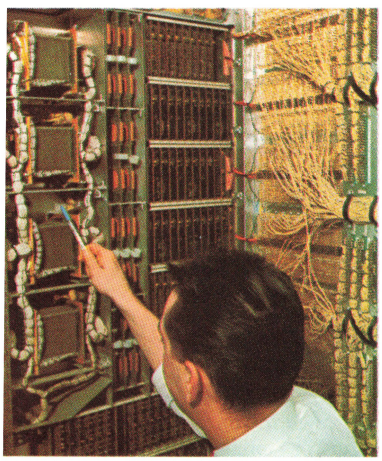


Memory. A bookkeeper stores data in an account book, *above*. Similarly, a computer stores data in its memory, *below*. Rings in the memory, *bottom*, are magnetized to represent numbers.

Processing. A bookkeeper uses a calculator, *above*, to do mathematical operations. A computer's arithmetic unit, *below*, performs similar operations with data stored in its memory. Thousands of electronic circuits, *bottom*, do the job.

Output. A bookkeeper writes his answers in an account book, *above*. A computer may print its data on a long sheet, *below*. A row of printing wheels, *bottom*, prints a line at a time.

WORLD BOOK photos by Edward F. Hoppe



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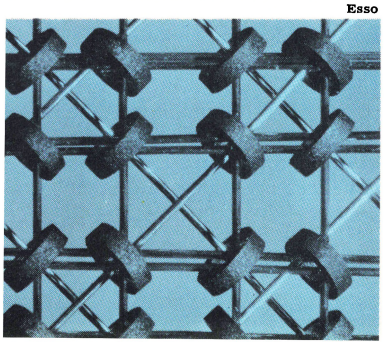
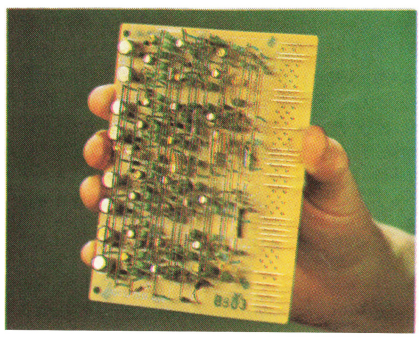
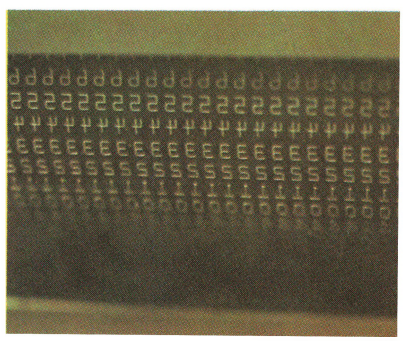






Arithmetic Unit gets data from the memory. It stores the data temporarily in its own storage devices, called *registers*. The registers connect with electronic circuits that perform mathematical operations according to commands from the control unit. After an operation has been completed, the answer appears as new data in the registers. The answer is transferred to the memory for storage until it is needed for another operation or is sent to output equipment.

Output Equipment includes card and tape punches, magnetic tape units, magnetic disk or drum units, automatic typewriters, high-speed printers, cathode ray tubes that display information, and voice response units.

Card and tape punches put information on punched cards and punched paper tape. Magnetic tape, disk, or drum units record data in magnetic form. Output information is put on punched cards; paper tape; and magnetic tape, disks, or drums so it can be put back into the computer easily when needed. Generally, automatic typewriters are used to print only small amounts of information because they can type only one character at a time. High-speed printers can print a whole line of more than 100 letters and numbers at a time, and 1,000 lines a minute. A cathode ray tube (CRT) displays information on a screen similar to a television screen. Some CRT's show only letters and numbers. Others display such information as drawings and graphs. A voice response unit sends data as spoken words through a telephone. To make such a response, the computer selects words and phrases from a collection of human-voice recordings.

COMPUTER/*Programming a Computer*

A computer by itself cannot solve any problem. A computer specialist called a *programmer* must tell the machine exactly what to do. He writes a set of instructions called a *program* that tells the computer what data to use and what operations to perform with the data. Preparing these instructions is called *programming*. The term *software* refers to computer programs and the information used in preparing them. The computer itself and its peripheral equipment are called *hardware*.

Most programs are so long and complicated that even an experienced programmer can make mistakes when writing them. He checks his program carefully and then tests it on the computer. If the computer does not work properly, the programmer must find his mistakes and correct them. Programmers refer to mistakes as "bugs," and call the testing procedure "debugging."

Planning a Program begins with a detailed description of the job the computer is to do. The programmer might get the job description from scientists and engineers who want to solve mathematical problems. Or he may get it from *systems analysts* (experts who plan information handling systems). The job description tells what input information is necessary, what processing must be done, and what the output should be.

A programmer or a systems analyst uses the job description to prepare a diagram that shows how all the parts of the job fit together systematically. This diagram is called a *systems flow chart*. The chart maker uses symbols to show how information will flow from input equipment, through the computer, to output equipment.

The systems flow chart helps the programmer prepare another diagram called an *operations flow chart*. In this chart, he breaks the job down into detailed steps that show the exact operations the computer must perform.

Writing a Program. The operations flow chart helps the programmer write the instructions that make up the program. The programmer writes the instructions on special forms called *coding sheets*. For most jobs, key punch operators then put the instructions on punched cards. Machines read the cards and send the program to tape units that record it on magnetic tape.

The programmer writes the program in a "language" consisting of certain words and symbols. The language he uses depends on the particular computer he is working with and on the job to be done. Computer languages include COBOL (COmmon Business Oriented Language), used in processing business data, and FORTRAN (FORmula TRANslation), used in solving problems of algebra. COBOL and FORTRAN are called *compiler languages*. They allow the programmer to write instructions for the computer using simple, common expressions.

Suppose that a computer is to update customers' accounts by subtracting a *credit* (amount of a payment) from the total amount each customer owes. The COBOL instruction for this operation would be:

SUBTRACT CREDIT FROM TOTAL

Programmers also use another kind of language called an *assembly language*. Assembly languages are somewhat harder to use than compiler languages because they involve symbols as well as words. The instruction above, when written in an assembly language, might be:

S CREDIT, TOTAL

The symbol *s* stands for *subtract*. The words *credit* and *total* represent addresses that tell where data for the operation are stored in the memory.

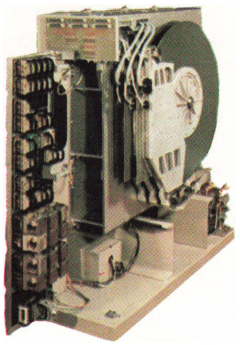
The computer cannot work directly with instructions written in compiler or assembly languages. The instructions must be translated into a *machine language* consisting of binary digits. Here is how the above instruction might appear in machine language:

011111 011110100010 000000101110

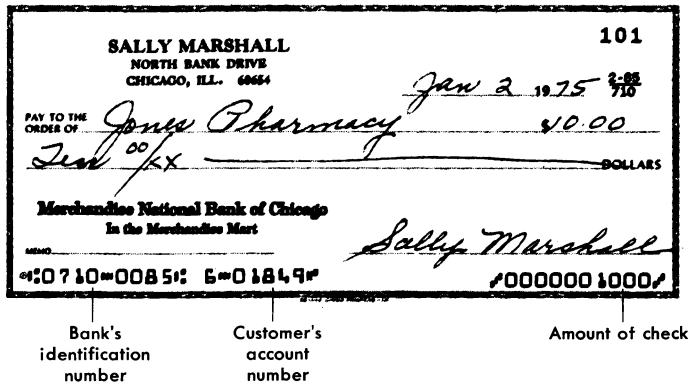
The first group of digits is an operation code meaning *subtract*. The next two groups are addresses of numbers stored in the memory. To perform the operation, the computer subtracts the number stored in the first address from the number stored in the second address.

Computer operators do not have to translate compiler and assembly languages into machine language. The computer does the translation itself with special programs written for this purpose. It usually records the program in machine language on magnetic tape. When the job is to be performed, the computer reads the tape and stores the program in its memory, along with other input information.

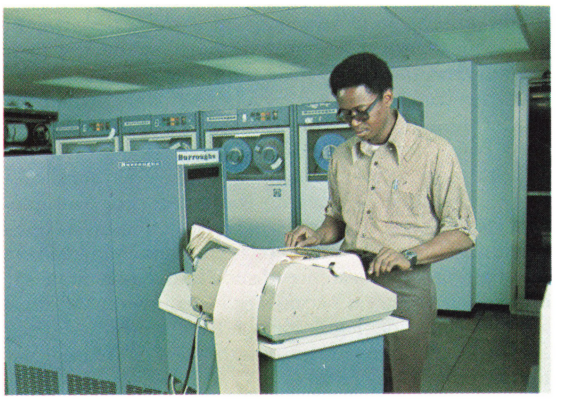
HOW A COMPUTER HANDLES CHECKING ACCOUNTS

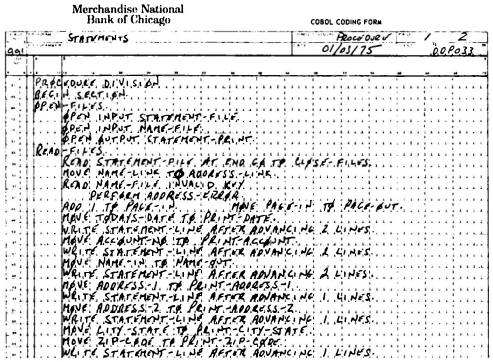


Burroughs Corp.

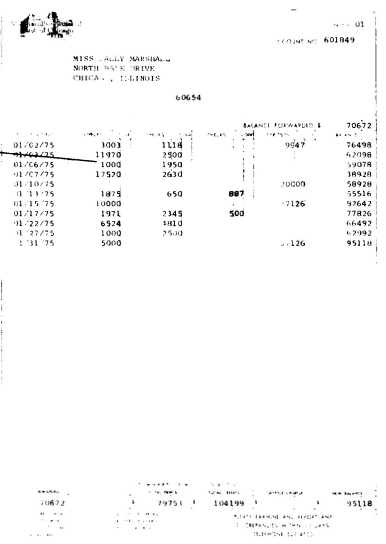


A Personal Check, *above right,* has numbers printed in magnetic ink in the lower left-hand corner. These numbers identify the check writer's bank and account. After a check has been cashed, it goes to the bank, where a clerk uses a machine to print in magnetic ink the amount written on the check. These numbers go in the lower right-hand corner of the check. Numbers printed in magnetic ink are read by another machine. It reads thousands of checks in a few minutes and records their numbers as magnetic spots on a magnetic disk machine, *above left.* A disk machine holds several rapidly spinning disks and can store the numbers from thousands of checks.

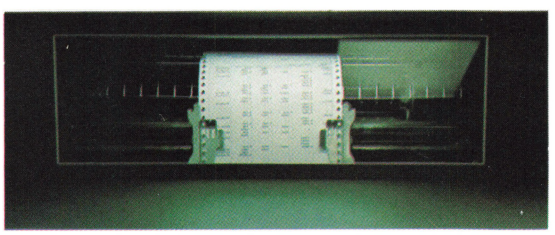




The Bank's Computer, *above,* reads the numbers from the disks and subtracts the amounts of cashed checks from the customer's account. A computer program, *above right,* tells the computer how to handle the numbers from the disks. The program also tells the computer how to prepare the customer's statement.



Customer's record of the check shown above



A High-Speed Printer, *above,* is controlled by the computer. It prints a monthly statement for each customer. This statement, *right,* lists cashed checks, deposits, and the amount remaining in the account.

Merchandise National Bank (WORLD BOOK photos)

The First Computers. Charles Babbage, an English mathematician, developed the idea of a mechanical digital computer in the 1830's. He designed and tried to build a complicated machine called an *analytical engine*. Babbage never completed his machine. But computers today are based on many of the principles used in Babbage's design.

About a hundred years later, in 1930, Vannevar Bush, an American electrical engineer, built the first analog computer. He called his machine a differential analyzer. During World War II (1939-1945), engineers developed electronic analog computers to help aim antiaircraft guns.

The first digital computer, called Mark I, was completed in 1944 by Howard Aiken, a Harvard University professor. Mechanical and electrical devices controlled the operation of Mark I. In 1946, engineers at the University of Pennsylvania built the first digital computer controlled by vacuum tubes. They called it the Electronic Numerical Integrator and Computer (ENIAC).

Perhaps the most important computer advancement during the 1940's was the work of John von Neumann, an American mathematician. Von Neumann developed the idea of storing the computer program in the machine's memory. Early computers had used programs, but did not store them in their memories.

In 1951, the builders of ENIAC developed UNIVAC I, the first of a variety of computers that were mass-produced during the 1950's. The manufacture of computers had become an industry.

Improved Computers. After computers began to be mass-produced, manufacturers introduced many improvements in design and operation. These improvements resulted in computers that worked faster and more reliably than earlier models. The new machines also were smaller and less expensive. For example, computers developed during the late 1950's and early 1960's had circuits controlled by transistors and memory units consisting of magnetic cores. These computers could perform operations in one-tenth the time it took earlier models, which used vacuum tubes and magnetic-drum memories.

During the 1960's, manufacturers developed a way of operating computers called *multi-programming* or *time-sharing*. This method makes it possible for many users to "share" a computer at the same time. A computer can handle more than one problem at a time because its CPU operates much faster than its peripheral equipment. The CPU works on one user's problem while the peripheral equipment processes input and output data for other users.

Computer engineers have also developed peripheral equipment that can be linked with a distant computer by telephone lines. Such remote terminals, along with time-sharing methods, permit many people at widespread locations to use a single computer.

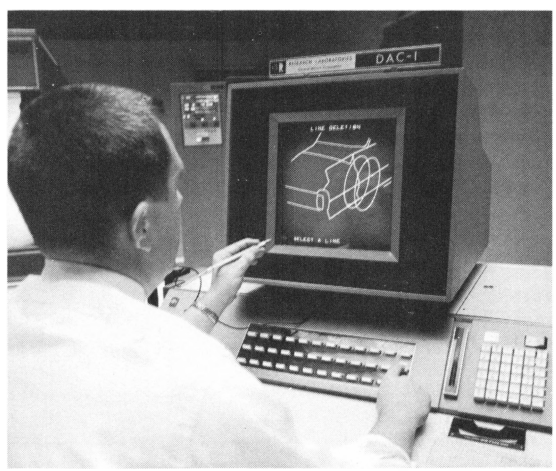
By 1970, about 75,000 computers were in use in the United States. Computer experts predict that this number will grow to more than 300,000 by 1980.

Computers of the Future will operate more and more as parts of "networks"—groups of several computers linked by communications lines. Network computers exchange data directly among one another. A network might also include terminals in banks, department stores, and homes. A store's customers could use their private terminal to do their shopping at home. If desired, the computer could then immediately deduct the cost of the purchases from the customer's account at a bank connected to the network.

Legal and social problems may arise as more and more information is put into computers. For example, *data banks*—large collections of facts—will grow as businesses and the government collect personal and business information. The existence of such data banks makes it difficult to protect a person's right to privacy. Various groups, including legislators and computer designers, are working to prevent the unauthorized use of information in data banks.

University of Pennsylvania

ENIAC, the first electronic digital computer, began operating in 1946. The U.S. Army Ordnance Corps used it to solve artillery problems. This computer contained about 18,000 vacuum tubes.



General Motors Corp.

Computerized Drawing Board, *above,* displays drawings stored in its memory. A designer can change a drawing by touching the screen with a device called a *light pen.*

COMPUTER/*Careers*

The development of computers has created career opportunities in such fields as automation, electronic data processing, and systems analysis. These fields deal with general principles of information handling and management that apply to all businesses. Computer specialists use their skills wherever computers help do a job. These experts can choose from an almost unlimited variety of jobs in education, government, industry, or science.

A computer specialist is basically a problem solver. He must have imagination so he can visualize difficult situations and find solutions to problems. He also should be creative so he can suggest new ideas and methods.

Above all, a computer expert needs training. This training may begin with a high school course in computer programming or with similar introductory courses. It should include at least a strong background in high school mathematics.

A college degree is desirable for almost every job in the computer field. College students may take courses in computer programming, computer languages, data processing, and systems analysis. At a university, these courses may be offered by the department of computer science, or by the departments of business, engineering, or mathematics. Many engineering schools include computer programming as a standard part of second- or third-year studies. A computer specialist may spend several months in on-the-job training to complete the preparation for his particular job.

Jobs associated with computers include: (1) computer operator, (2) computer sales representative, (3) data processing manager, (4) design engineer, (5) key punch operator, (6) programmer, (7) service engineer, (8) systems analyst, and (9) tape and disk librarian.

Computer Operator controls the computer and its input and output equipment. This specialist works at a control unit called a *console*. The computer operator keeps records telling what jobs the computer does and how long each job takes. The operator also may schedule new jobs.

Computer Sales Representative sells computers and related equipment, products, and services. He must have training in marketing and in computer applications, and must be familiar with the customer's business.

Data Processing Manager directs the people who program and operate a computer. The manager must have experience in using computers, and must be skilled in dealing with people.

Design Engineer works on the research and development of computers and of their input and output equipment. The designer tries to create new machines that are faster and smaller than existing machines, but able to do even more work. The design engineer also tries to improve machines to make them easier for programmers and operators to use. The job of computer design engineer requires at least a bachelor's degree in a field such as electronics. Many design engineers have master's or doctor's degrees.

Key Punch Operator uses a machine resembling a typewriter to prepare data for computer handling. The machine may punch holes in cards or paper tape. A key punch operator may also operate a data entry device that puts the information directly onto magnetic tape or disks. A high school graduate may learn to operate either machine with two or three weeks of training.

Programmer writes the instructions that the computer follows in doing a particular job. For a detailed description of the programmer's job, see the section on *Programming a Computer* in this article.

Service Engineer keeps computers in working order. Most service engineers are employed by computer manufacturers to work with their customers.

Systems Analyst determines how a computer will fit into the overall picture of the people and machines that do a particular job. The analyst must know everything about the job and about the equipment that is to do the job. The systems analyst not only serves the persons who want a job done, but also helps the programmers and operator who actually do it. See SYSTEMS ANALYSIS.

Tape and Disk Librarian supervises the storage of a computer's magnetic tape reels and disk packs. The librarian also keeps records of what information is stored on the tapes and disks.

EVAN F. LINICK

COMPUTER/*Study Aids*

Related Articles in WORLD BOOK include:

Abacus
Adding Machine
Aircraft Instruments (Flight Director)
Automation
Bush, Vannevar
Cash Register
Cybernetics
Electronics
Guided Missile (diagrams)
Gyropilot
Information Retrieval
Printing (Electronic Computers)
Space Travel (Piloting a Spacecraft; Aiming at the Moon)
Typewriter (History)

Outline

I. Kinds of Computers
  A. Digital Computers
  B. Analog Computers
II. Parts of a Digital Computer
  A. Input Equipment
  B. Memory
  C. Control Unit
  D. Arithmetic Unit
  E. Output Equipment
III. Programming a Computer
  A. Planning a Program
  B. Writing a Program
IV. History
V. Careers

Questions

What is a computer *program?*

How do computer memory rings store information?

What common computer language is used in processing business data?

How do analog computers represent numbers?

How do electronic digital computers differ from adding machines and other figuring machines?

What information does each instruction of a computer program include?

What is "debugging"? Who performs this job?

How do *compiler languages* differ from *machine language?*

How do magnetic disk and drum units differ from magnetic tape units?

What are the main parts of a general purpose, digital computer?

Reading and Study Guide

See *Computer* in the RESEARCH GUIDE/INDEX, Volume 22, for a *Reading and Study Guide.*

COMPUTER-ASSISTED INSTRUCTION. See EDUCATIONAL PSYCHOLOGY.

COMSAT. See COMMUNICATIONS SATELLITE CORPORATION.

COMSTOCK LODE consisted of several immensely rich veins of silver and gold in Nevada. One part alone produced nearly $200 million worth of ore. Ethan and Hosea Grosh of Pennsylvania discovered silver near the site in 1856, but died before developing their claim. The claim was rediscovered in 1859, and a great stampede began. The lode took its name from Henry J. P. Comstock, one of the 1859 claimants. Virginia City, Nev., grew up on the site of the lode. WALKER D. WYMAN

See also NEVADA (The Comstock Lode).

COMTE. See COUNT.

COMTE, *kawnt*, **AUGUSTE** (1798-1857), was a French social thinker and philosopher. He founded the philosophy known as *positivism*, and originated a concept of social science which he called sociology.

Comte sought to discover the laws that he believed governed the evolution of the mind. In his book, *The Course of Positive Philosophy* (1830-1842), he framed his "law of the three states." This law advanced the idea that men try to understand phenomena in three ways. Comte believed that men first seek a *theological* (supernatural) explanation; then a *metaphysical* (abstract) explanation; and finally a *positive* explanation. The positive explanation is derived from an objective examination of the phenomena themselves. Comte believed that students should concern themselves only with phenomena that have an objective, "positive," existence. This belief forms a basis of positivism.

Comte regarded all social thought as an interrelated whole, the laws of which can be found by assembling what he considered the facts. His ideas have influenced students of historical and social theory, and of criminology, and such authors as Herbert Spencer and John Stuart Mill, who were seeking a "science of society." Comte was born at Montpellier. ERNEST JOHN KNAPTON

See also SOCIOLOGY (Beginnings).

CON-CON. See POLITICAL CONVENTION (Other Types of Political Conventions)

CONAKRY, *KAHN uh kree* (pop. 45,304; met. area 197,267), is the capital, chief seaport, and commercial center of Guinea. It lies on Tombo Island (see GUINEA [map]). A bridge connects it with the mainland. The chief exports of Conakry include bananas and palm kernels. ALAN P. MERRIAM

CONANT, JAMES BRYANT (1893-), is an American scientist, educator, and diplomat. As a professor of organic chemistry at Harvard University, he helped unravel the mysteries of such molecules as *chlorophyll* (green coloring matter in plants) and *hemoglobin* (red coloring matter in blood). From 1930 to 1949, he served on the Board of Scientific Directors of the Rockefeller Institute (now Rockefeller University). During World War II, he was chairman of the National Defense Research Committee. He served as president of Harvard University from 1933 to 1953. He served as ambassador to West Germany from 1955 to 1957. He later made studies of schools and teacher education for the Carnegie Foundation. In 1963, he became chief educational consultant in Europe for the Ford Foundation. Conant's books on chemistry and on his philosophy of education have had wide influence. His books include *The American High School Today* (1959), *The Education of American Teachers* (1963), and *My Several Lives* (1970). Conant was born in Dorchester, Mass. HERBERT S. RHINESMITH

CONCENTRATION CAMP is a place where political enemies, real or assumed, are imprisoned, usually without trial. The term was first used by Great Britain for prison camps it set up during the Boer War in Africa around 1900. Russian secret police imprisoned millions of persons in labor camps after 1928, during Joseph Stalin's dictatorship. During World War II, the United States and Canada held thousands of persons of Japanese ancestry in special camps (see WORLD WAR II [Internment of Aliens]). But the best known concentration camps were those set up in Nazi Germany before and during World War II.

After the Nazis came to power in 1933, they used concentration camps to imprison political enemies and to terrorize the German people. Most early prisoners were Communists and other political opponents. Many, however, were Jews arrested on false charges. Prisoners were almost always treated brutally, and many of them died. By 1939, the Nazis had six camps, including those at Dachau and Buchenwald.

When World War II began, the number of camps quickly increased to 22. They were filled with persons of all European nationalities, and included prisoners of war as well as civilians. An estimated 7 to 8 million persons were imprisoned by the Nazis between 1933 and 1945. Some prisoners were sent to manufacturing plants to work. Others were forced to perform dangerous or degrading tasks in the camps or other places.

In 1942, the Nazis decided to rid Europe of all Jews. By the war's end, they had murdered about 6 million. At first, they used firing squads. Later, they used spe-

The Nazi Concentration Camp at Auschwitz, Poland, opened in 1940. About 2½ million persons were executed there during World War II.

Elliott Erwitt, Magnum

cial gas chambers to kill large groups of victims at a time with poison gas. Others died as the result of experiments performed on them by doctors and scientists. About 2½ million persons were executed at Auschwitz, an extermination camp in Poland. Many others died, chiefly of starvation, at Buchenwald, in Germany.

Allied forces reached the camps in 1945. They found thousands of unburied dead, and survivors who were crippled, insane, or dying of disease or starvation. During the Nuremberg Trials after the war, many Nazi leaders were convicted of crimes against humanity. Some were executed. GEORGE G. WINDELL

See also AUSCHWITZ; BELSEN; BUCHENWALD; DACHAU.

CONCEPCIÓN, *kohn sehp SYOHN* (pop. 187,251), Chile's third largest city, is on the banks of the Bío-Bío River, 6 miles (9.7 kilometers) from the Pacific Ocean (see CHILE [political map]). A railroad connects Concepción with its port, Talcahuano, 9 miles (14 kilometers) away. The city is a shipping and processing center for farm products.

CONCEPT is a person's idea of a class of objects, such as *cat*, *horse*, and *house*, or of ideas, such as *love*, *liberty*, or *God*. It is a consciousness of those qualities that make an object or idea what it is or appears to be. Much of philosophy consists of man's attempts to define concepts. All nouns are man-made concepts.

A person may form concepts as the result of such things as observation, reading, or personal experience. A child may get his first idea of what cats are like by observing the size, color, and other features of his own pet kitten. When he sees another cat, he reconstructs his idea to leave out those qualities not common to both cats. After he has seen many cats, he learns that all cats have certain common features. He blends these features into his *concept* (general idea) of *cat*.

A person can form concepts without having any direct experience with what the concepts stand for. Such concepts may be learned from other persons or from reading. Most Americans form their ideas of such concepts as *Communism* or *Hinduism* in this way.

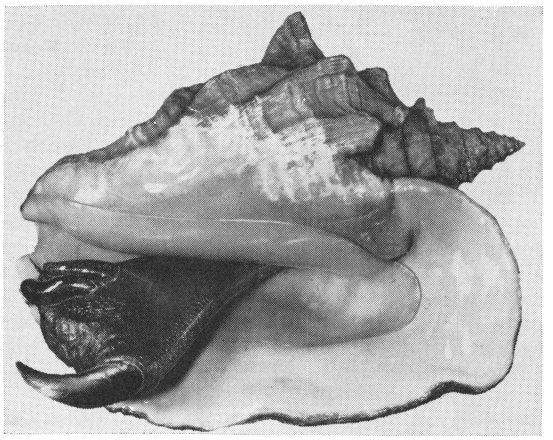
The meaning given to a concept may be different among various groups of people. The meanings of *socialism* or *morality*, for example, differ widely because persons in various parts of the world associate different aspects of human behavior with these concepts. Generally, persons who have common experiences and common purposes in developing a concept assign about the same meaning to the concept. Scientists have tried to standardize the meanings of concepts in science. But even these meanings change as new knowledge is obtained. For example, the concepts of *relativity* and *atom* have changed radically. HADLEY CANTRIL

See also THOUGHT AND JUDGMENT (Concept Attainment).

CONCEPTUS. See EMBRYO (Fertilization).

CONCERTINA, *KAHN suhr TEE nuh*, is a musical instrument in which metal reeds are made to vibrate by air pressure produced by means of a bellows. The player presses small keys or plugs in the end plates of the instrument. These keys open valves that control the reeds. The treble concertina used the most is a small, six-sided instrument with a range of about 3½ octaves. There are also tenor, bass, and contrabass concertinas. Charles Wheatstone patented the concertina in 1829. See also WHEATSTONE, SIR CHARLES. CHARLES B. RIGHTER

CONCERTO, *kuhn CHEHR toh*, is a musical composition in which a solo instrument, such as a violin, plays with orchestral accompaniment. A concerto usually has three movements, and resembles the sonata in form (see SONATA). Concertos may be written for more than one soloist. Beethoven wrote a triple concerto for piano, violin, violoncello, and orchestra. RAYMOND KENDALL



American Museum of Natural History

The Conch has a meaty body that can move in and out of the spiral shell. The animal uses a claw on its body to move about.

CONCH, *kahngk*, is a large, heavy sea snail with a spiral shell. The name *conch* comes from a Greek word meaning *shell*. Conchs live in the world's shallow seas.

Conch shells have many uses. They can be ground up to make *porcelain* (china), or burned to make lime. Some conch shells are used to make buttons and cameos. The shell of an East Indian species, the *Triton's trumpet*, is used as a horn. The egg cases of certain conchs look like leathery wafers strung on a cord. These strings of egg cases are called *sea necklaces*. Meat of the West Indian pink conch is used in chowder and salad.

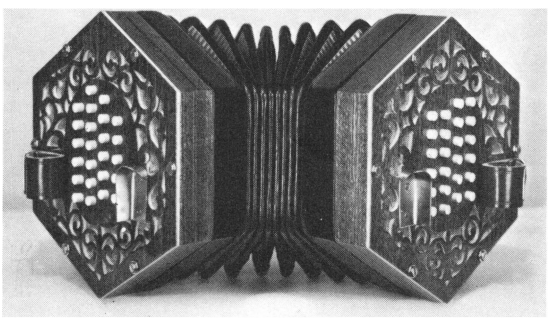
Scientific Classification. Conchs are in the phylum *Mollusca* and the class *Gastropoda*. R. TUCKER ABBOTT

See also MOLLUSK; SHELL (color picture).

CONCHOLOGY. See SHELL (Collecting Shells).

The Concertina is more popular in Europe than in the United States. It produces a sound somewhat like that of an accordion.

David Wexler & Co.



CONCILIATION is a method of settling conflicts between two parties peacefully. Conciliation involves the efforts of a third party. If the opposing parties agree to the procedure, the third party tries to arrange a compromise. A third party may be another state or an international organization. Conciliation is an important function of the United Nations. Sometimes conciliation succeeds only in stopping hostilities between belligerents, as in the case of the Arab-Israeli conflict. *Mediation* and *good offices* are similar procedures. WILLIAM T. R. FOX

See also UNITED NATIONS (Working for Peace).

CONCLAVE, *KAHN klayv,* is the assembly and place of meeting of the cardinals of the Roman Catholic Church for the election of a pope. The word in French or Latin means a *room which may be locked.* In a wider sense, it also refers to any private meeting. Long ago the clergy and the people chose the popes, but often amid great confusion. The present method dates back to 1274. Soon after the death of a pope, the cardinals meet in the city in which he died. The public may view the meeting place on the first day. Thereafter the cardinals are locked in and allowed no communication with the outer world until after the election. FULTON J. SHEEN

See also CARDINAL; POPE; SACRED COLLEGE.

CONCORD, Mass. (pop. 16,148), is an attractive residential town noted for its historic and literary attractions. It lies 19 miles (31 kilometers) northwest of Boston. For location, see MASSACHUSETTS (political map).

Concord's largest industries engage in the manufacture of electronic test equipment and in metallurgical research. The Concord grape originated in Concord.

A group of Puritans founded Concord in 1635. Concord became a center of pre-Revolutionary War activity and a storage area for military supplies. Minutemen from the surrounding countryside rallied to oppose British forces searching for these supplies. The patriots exchanged shots with British troops in a brief battle at Concord's North Bridge on April 19, 1775. The fight was one of the opening battles of the Revolutionary War in America. Today, a replica of the bridge and a statue called *The Minute Man* by Daniel Chester French mark the battleground. See CONCORD, BATTLE OF; MINUTEMAN (pictures).

Concord was the center of American writing in the mid-1800's. Bronson Alcott, Louisa May Alcott, Ralph Waldo Emerson, Nathaniel Hawthorne, and Henry Thoreau lived and wrote there. Visitors are welcome at Emerson House; at the Old Manse of Hawthorne and Emerson; at Orchard House, where Louisa May Alcott wrote most of *Little Women;* at The Wayside, where Hawthorne lived; and at the Antiquarian Museum, which features antiques of famous persons. Nearby are Thoreau's Walden Pond, and Sleepy Hollow Cemetery, where most of the writers who lived in Concord are buried. Concord is governed by a town meeting and town manager. WILLIAM J. REID

CONCORD, N.H. (pop. 30,022), is the capital and third largest city in the state. It is located on the Merrimack River in south-central New Hampshire (see NEW HAMPSHIRE [political map]). Called Penacook when it was founded in 1727, it took the name Rumford in 1733, and assumed its present name in 1765. Concord became the state capital in 1808.

The chief economic activities of Concord center around granite quarries, printing plants, and factories that make electronics products, leather belting, and wood products. Concord is a major retail trade center. Concord has about 20 public schools, the state historical society, and state and city libraries. The last home of President Franklin Pierce stands in Concord. The city has a mayor-council government. J. DUANE SQUIRES

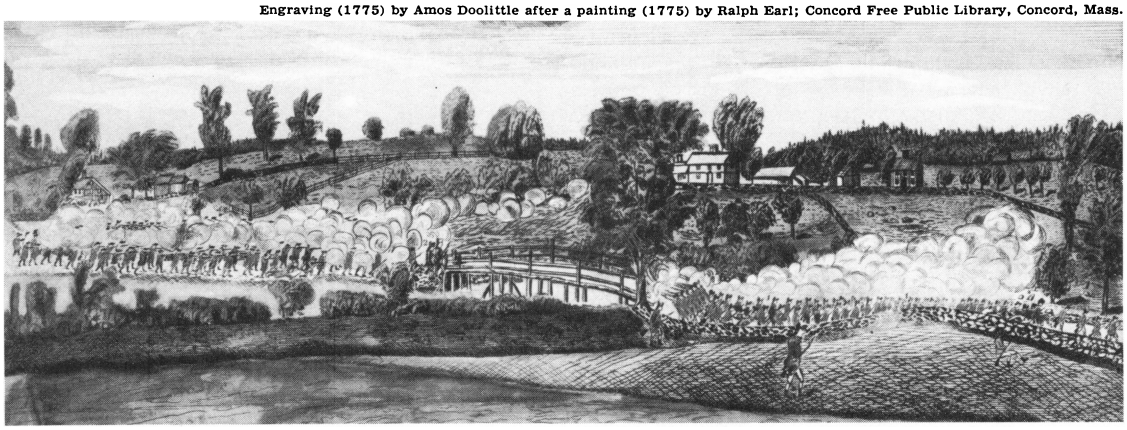
For the monthly weather in Concord, see NEW HAMPSHIRE (Climate). See also NEW HAMPSHIRE (color picture: State Capitol).

CONCORD, BATTLE OF, on April 19, 1775, marked the second clash between the patriots and the British in the Revolutionary War in America. The opening battle of the war had been fought at nearby Lexington, Mass. During the previous winter, the Americans had gathered military supplies in case of war. The British government ordered its commander in chief in Boston, Lieutenant General Thomas Gage, to destroy the supplies at Concord. On the night of April 18, Gage sent 700 troops under Lieutenant Colonel Francis Smith to carry out this command. But Paul Revere and William Dawes warned the countryside that the British were coming.

After a clash at Lexington early the next morning, the British continued on to Concord, 6 miles (10 kilometers) beyond. The Americans retreated across North

American Patriots Fought British Troops at the North Bridge During the Battle of Concord in 1775.

Engraving (1775) by Amos Doolittle after a painting (1775) by Ralph Earl; Concord Free Public Library, Concord, Mass.



Bridge, outside Concord. The main force of British troops searched for the patriots' supplies in the town, while others guarded the bridge. Several hundred colonists marched on the bridge and exchanged shots with the British troops there. Three British soldiers and two Americans were killed in the battle. A few hours after the battle, Smith's men headed back toward Boston. MERRILL JENSEN

See also REVOLUTIONARY WAR IN AMERICA (picture).

CONCORDAT, *kahn KAWR dat,* is an agreement, especially one between the pope and a civil government, to regulate the affairs of the Roman Catholic Church within that state. A concordat may be announced by a decree from the pope, called a *papal bull,* or by a formal treaty. Pope Pius XI made an important concordat with the Italian government in 1929. It regulated ecclesiastical affairs with Italy. FULTON J. SHEEN

CONCORDAT OF WORMS. See CHURCH AND STATE.

CONCORDIA COLLEGE. See UNIVERSITIES AND COLLEGES (table).

CONCORDIA UNIVERSITY is a coeducational school in Montreal, Canada. It receives financial support from the province of Quebec. Concordia has divisions of arts and science, commerce and administration, engineering and computer science, and fine arts. It offers special programs in biophysical education, Canadian studies, communications arts, early childhood education, theater, and urban studies. The university also has an evening division and a division of continuing education. Courses lead to bachelor's, master's, and doctor's degrees.

Concordia University was established in 1974 through the merger of Sir George Williams University and Loyola College of Montreal. For enrollment, see CANADA (table: Universities and Colleges).

Critically reviewed by CONCORDIA UNIVERSITY

CONCRETE. See CEMENT AND CONCRETE.

CONCRETION is a mass of minerals that have become cemented together to form a deposit in sedimentary rock. Concretions range in size from less than 1 inch (2.5 centimeters) to more than 1 foot (30 centimeters).

CONCURRENT FORCES. See MOTION (Newton's Laws).

CONCUSSION is a condition that results from a violent blow or shock. For example, a blow on the head may cause concussion of the brain. The blow interferes with the brain's normal function. The person becomes dizzy and nauseated, and may lose consciousness.

CONDE. See COUNT.

CONDEMNATION OF REAL PROPERTY. See EMINENT DOMAIN.

CONDENSATION, *KAHN dehn SAY shuhn,* is the process by which a substance changes from a gas into a liquid. Condensation of a gas to a liquid takes place when the temperature of the gas is lowered below its boiling point. When the temperature of steam drops below 100° C, the steam changes into droplets of water. Some gases condense so easily that either cooling them or increasing the pressure will change them into their liquid state. Other gases condense at such low temperatures that they require both cooling and high pressure to change them to a liquid state. Every known gas can be condensed into liquid form.

Helium is the most difficult to condense. Its boiling point is −268.9° C. Air, under high pressure, begins to condense at −140° C. Under certain conditions, a gas may condense directly to the solid form. For example, snow crystals form directly from water vapor in the atmosphere when the temperature is below the freezing point. LOUIS MARICK

See also DEW; DISTILLATION; GAS (matter); LIQUID.

CONDENSATION TRAIL. See CONTRAIL.

CONDENSED MILK is a form of canned concentrated milk. It is made by evaporating about 60 per cent of the water from fresh whole milk or skim milk. Condensed milk was invented by Gail Borden. He received a patent in 1856 for the commercial manufacture of condensed milk. Evaporated milk, which has no added sugar, has largely replaced condensed milk (see EVAPORATED MILK). GLENN H. BECK

CONDENSER. See CAPACITOR.

CONDENSER, STEAM, is a device used on steam turbines to increase the amount of work they can do. A steam condenser consists of a chamber filled with pipes. Cool water flows through the pipes. Steam leaving the turbine passes through the chamber and is cooled by the pipes. This condenses the steam into a liquid and creates a low-pressure area in the chamber.

Without a condenser, steam escaping from a turbine would have to push against atmospheric pressure of 14.7 pounds per square inch (1 kilogram per square centimeter). But the pressure in the condenser is only about 0.7 pound per square inch (0.05 kilogram per square centimeter). Thus, more of the energy of the steam can be used, because it does not have to push against the higher atmospheric pressure. OTTO A. UYEHARA

See also CONDENSATION; TURBINE (Steam Turbines).

CONDIMENT, or SEASONING, is anything used to give relish to food and to gratify the taste. Condiments are usually pungent substances, as pepper or mustard.

CONDITIONED REFLEX. See REFLEX ACTION.

CONDITIONING. See LEARNING (How We Learn).

CONDOMINIUM. See HOUSING (Condominium).

CONDOMINIUM, *KAHN duh MIHN ee uhm,* is joint rule or sovereignty over a territory. This type of rule is rare. The Republic of Sudan was once under the joint sovereignty of Great Britain and Egypt. Great Britain, Germany, and the United States shared control of Samoa, a group of 14 islands in the South Pacific Ocean, from 1889 until 1899. The islands were then divided between Germany and the United States. The German group is now independent Western Samoa.

Great Britain and France together rule the New Hebrides. The word *condominium* is from two Latin words, meaning *together* and *domain.* See also COMMONWEALTH OF NATIONS; SUDAN (History). WILLIAM T. R. FOX

CONDON, EDWARD UHLER (1902-1974), an American physicist, became noted for his contributions to theoretical physics. In 1928, he helped apply new quantum theories to radioactive processes (see QUANTUM MECHANICS). Condon was born in Alamogordo, N.Mex., near the site of the first atomic-bomb test. He received a Ph.D. degree from the University of California in 1926. He taught at Princeton University and at the University of Minnesota, and became a professor at Washington University in 1956. From 1963 to 1970, Condon taught at the University of Colorado. He retired in 1970. RALPH E. LAPP

CONDOR

CONDOR is a large vulture. The condor of North America, called the *California condor*, is the largest land bird on the continent. It reaches a length of 45 to 55 inches (114 to 140 centimeters), has a wingspread of $8\frac{1}{2}$ to 10 feet (2.6 to 3 meters), and weighs between 20 and 25 pounds (9 and 11 kilograms). Only about 40 California condors are still living today. These birds live in a sanctuary in Los Padres National Forest in southern California.

The California condor has a long hooked beak that extends almost straight out from its flat forehead. It has a bald yellow or orange head and reddish neck. Blackish feathers cover most of the condor's body. A ruff of feathers circles the base of the neck. White feathers are under each wing.

Like other vultures, the condor feeds chiefly on the bodies of dead animals. It usually nests in caves high on cliffs. The female lays one egg on the bare floor of the cave. The egg is about $4\frac{1}{2}$ inches (11 centimeters) long and $2\frac{1}{2}$ inches (6.4 centimeters) wide, large enough to hold more than a half-pint (0.24 liter) of water. The egg is plain white with a greenish or bluish tint. California condors are rare. This is because the large animals they eat are scarce; and many condors have been killed by man. They are also rare because of a slow rate of reproduction. A condor does not breed until it is six years old and lays only one egg every two years. Young condors grow slowly.

The *South American condor* is about the size of the California condor. It lives high in the Andes Mountains, and may fly as high as 20,000 feet (6,100 meters). The female lays two white eggs. The South American condor appears on the coat of arms of Bolivia, Chile, Colombia, and Ecuador.

Scientific Classification. Condors are in the American vulture family, *Cathartidae*. The California condor is genus *Gymnogyps*, species *G. californianus*. The South American condor is *Vultur gryphus*. OLIN SEWALL PETTINGILL, JR.

See also BIRD (Young Birds; picture: Soaring Birds); VULTURE.

California Condor
Gymnogyps californianus
Found in southern California
Body length 50 inches (130 centimeters)

South American Condor
Vultur gryphus
Found in the Andes, from Venezuela and Colombia to the Strait of Magellan
Body length 52 inches (132 centimeters)

WORLD BOOK illustrations by Albert E. Gilbert

CONDORCET, *con dor SAY*, **MARQUIS DE** (1743-1794), was a French philosopher. His major work was *Sketch for a Historical Picture of the Progress of the Human Mind* (1793-1794). Condorcet believed that human nature could be perfected and that history showed man's steady progress toward an enlightened civilization. He opposed monarchy and all forms of religion. He felt that the evils of his time resulted from inadequate institutions and laws created by rulers and priests. Condorcet believed that history up to his time consisted of nine *epochs* (periods). During the 10th epoch, which he projected for the future, equality would develop among all nations and classes of people, and people would improve physically, intellectually, and morally.

Condorcet was born in Picardy. He was a brilliant mathematician and was elected to the French Academy. He supported the French Revolution and served in the revolutionary Legislative Assembly and Convention. But eventually he was arrested as an enemy of the revolution. He died in prison. STEPHEN A. ERICKSON

CONDUCT. See BEHAVIOR; ETIQUETTE.

CONDUCTING is the art of leading a musical group in performance. A conductor usually uses hand motions that give the beat and guide the performers in tempo and dynamics. A conductor must be a skilled musician. He must have an exceptional ear for rhythm and pitch, and know the music of both past and present.

The use of hand motions to direct musical performers dates back to early times. Hand signals called *cheironomy* were used in Gregorian chants before musical notation became highly developed. The signals reminded the singers of the pitches and rhythms they had learned by ear. In small musical groups, one player usually kept the performers together. When large numbers of musicians began to perform together, they found it necessary to have one principal leader. In the 1600's, the composer often served as leader, conducting from the keyboard. Later, the leading violinist sometimes waved his bow to give signals while playing. About 1820, Louis Spohr, a German violinist, began using a small stick to conduct in public. This gave rise to the baton (see BATON). The tradition of specialized conducting became established by about 1850. Today, the conductor holds a position of great authority. GRANT FLETCHER

See also ORCHESTRA with its Related Articles, which has a list of biographies of conductors.

CONDUCTION. See HEAT (How Heat Travels).

CONDUCTOR, ELECTRICAL. See ELECTRIC CURRENT (Conductors and Insulators).

CONDUCTOR, RAILROAD. See RAILROAD (Railroad Workers).

CONDUIT. See VOLCANO (How Volcanoes Are Formed; picture: Cross Section of a Volcano).

CONDUIT, *KAHN diht*, is a tube or sheath that encloses and protects electrical wires. The form of conduit used depends on the size and number of wires and on the purpose for which the wires are used. In the typical small home, nonmetallic conduits, usually plastic, protect pairs of wires. Pairs of wires may also be held in a flexible metal sheath called *BX cable*. In larger structures, such as factories, conduits consist of hollow metal tubes that are several inches in diameter. Sometimes a metal *raceway* (trough) acts as a conduit. A flexible waterproof conduit often protects the wire in places where moisture or weather might harm the wiring. In almost all cases, the connections for wires in conduits are made only at junction boxes. SAMUEL SEELY

CONE, a part of the eye. See EYE (The Eyeball); COLOR (How the Eye Sees Color).

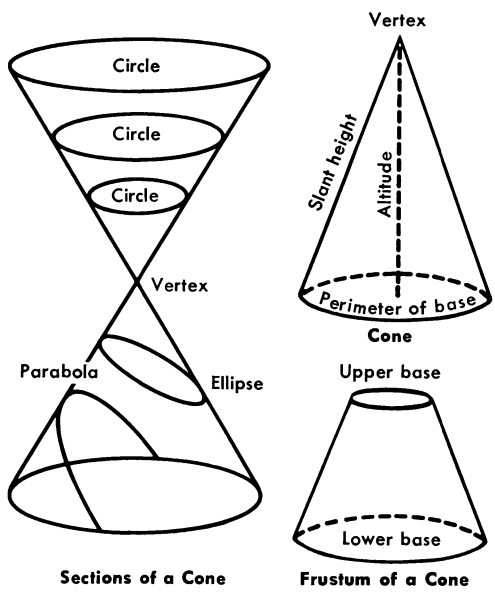
CONE is a solid figure whose base lies on a plane and is bounded by a closed curve, and whose *lateral surface* (side) tapers uniformly to a point called the *vertex*. The cone that occurs in most practical problems is called a *right circular cone*. Its base is a circle. The line drawn from the vertex to the center of the base is perpendicular to the base. This perpendicular line is called the *altitude* of the cone. A line from the vertex to a point on the circumference of the base is the *slant height*. If you cut off the top of a cone with a plane parallel to the base, the portion of the cone that remains is called a *frustum*.

The Area of the Lateral Surface of a cone equals the circumference of the base of the cone multiplied by half of the slant height. If L stands for the area of the cone's lateral surface, r for the radius of the base, and s for the cone's slant height, then $L=(2\pi r)\ (\frac{1}{2}s)$ or $L=\pi rs$.

The Volume of a Cone equals one-third that of a cylinder with the same base and altitude. If V stands for the volume, B for the area of the base, and h for the altitude, $V=\frac{1}{3}Bh$, or $V=\frac{1}{3}\pi r^2h$.

The Area of the Lateral Surface of a Frustum equals the product of half the slant height and the sum of the circumferences of the bases. If L stands for the area of the frustum's lateral surface, R for the radius of the upper base, s for the slant height, and r for the radius of the lower base, then $L=\frac{1}{2}s(2\pi r+2\pi R)$ or, $L=\pi s(r+R)$.

The Volume of the Frustum of a cone is found by multiplying one-third of the altitude by the sum of the areas of the two bases, plus the square root of their product. Thus, $V=\frac{1}{3}h(\pi r^2+\pi R^2+\sqrt{\pi r^2\times\pi R^2})$ or, $\frac{1}{3}h\pi(r^2+R^2+rR)$. The volume of the frustum may also



be found by completing the cone. It is the volume of the top cone subtracted from the volume of the entire large cone. MILES C. HARTLEY

See also CIRCLE; CYLINDER; ELLIPSE; HYPERBOLA; PARABOLA.

CONE-BEARING PLANT, also called CONIFER, is a tree or shrub that bears its seeds in cones. Conifers do not produce a pod or other fruit that must break open to set the seeds free. The seeds fall out from between the scales of the cones. Most cone-bearing plants grow in temperate climates. The leaves are usually small, evergreen, and needle-shaped. A few conifers that grow in subtropical climates have long, leathery leaves. On most cone-bearing plants, the leaves stay on the plant for several years. Common conifers include the pines, hemlocks, spruces, firs, junipers, cedars, larches, redwoods, yews, and cypresses.

Conifers have male and female flowers. Both are usually on the same plant. The male flowers give off pollen. They are arranged in catkinlike clusters called *strobiles* (see CATKIN). Each female flower has a seed-producing cone at the top. When the female flowers are pollinated, they develop into cones. In some cone-bearing plants, it takes only a few months for the cones to ripen. In others, such as the pine, it takes two years. Juniper cones resemble blueberries. Yew cones look like red berries with one large seed. The yew's male and female flowers grow on two different plants.

When the seeds of a conifer are fully formed, they fall from the cones. They grow into new plants.

Scientific Classification: Cone-bearing plants make up the order *Coniferales*. There are several families and many genera in the order. K. A. ARMSON

Related Articles in WORLD BOOK include:

Arborvitae	Fir	Plant (pictures: Cone-Bearing Plants)
Bald Cypress	Ginkgo	
Balsam Fir	Gymnosperm	
Bristlecone Pine	Hemlock	Redwood
Cedar	Juniper	Sequoia
Cycad	Larch	Spruce
Cypress	Pine	Tree (Needleleaf Trees; pictures)
Douglas Fir	Piñon	
Evergreen		Yew

CONESTOGA WAGON was a sturdy, colorful covered wagon used by American pioneers. It was named for the Pennsylvania town where it was first built in the middle 1700's. Conestogas carried most of the freight and people that moved west over the Alleghenies from the time of the Revolutionary War until about 1850. These wagons were sometimes called the *camels of the prairies*.

Both ends of the wagon were built higher than the middle. The white canvas roof was high and rounded. Wheels with broad rims prevented bogging down in mud. These could be removed and the wagon could be used as a boat. Conestoga wagons were drawn by teams of from four to six horses. JOHN J. FLOHERTY

See also PENNSYLVANIA DUTCH; WESTERN FRONTIER LIFE (color picture).

CONEY. See CONY.

CONEY ISLAND is a popular New York seaside resort. Actually it is an island in name only, since land has been filled in connecting it with Brooklyn. Coney Island is famous in history as the place where Henry Hudson landed in 1609. Thousands of people seek relief there from the heat of summer. Coney Island lies at the southwestern end of Long Island, about 9 miles (14 kilometers) from the southern tip of Manhattan Island. For location, see NEW YORK CITY (map). It is nearly 5 miles (8 kilometers) long at the longest part, and three-quarters of a mile (1.2 kilometers) across. Coney Island may be reached by automobile, bus, subway, or boat. Sometimes more than a million people visit "Coney" in a day. In the immediate vicinity are Brighton Beach, West Brighton, Sea Gate, and Manhattan Beach.

Pennsylvania Historical and Museum Commission

Conestoga Wagons replaced horse pack trains, and were the long-distance freight carriers before the railroads were completed.

A true outing at Coney Island includes a trip along the Boardwalk, a wide thoroughfare that stretches along the beach for about 1 mile (1.6 kilometers). The patrons crowd the souvenir stands, see side shows, and visit the New York Aquarium. They also swim, dance, play games of chance, and take thrilling rides. There is little activity at "Coney" in winter. WILLIAM E. YOUNG

CONFECTION. See CANDY.

CONFEDERATE ARMY SOCIETIES. See CONFEDERATE VETERANS, UNITED; DAUGHTERS OF THE CONFEDERACY, UNITED.

CONFEDERATE MEMORIAL DAY honors Confederate soldiers who died in the Civil War. Tennessee and Virginia celebrate this day annually on the last Monday in May, which is Memorial Day in most of the country. Mississippi celebrates Confederate Memorial Day on April 25, and Alabama and Georgia celebrate the day on April 26. North Carolina and South Carolina observe May 10. Kentucky and Louisiana observe June 3, the birthday of Jefferson Davis.

The tradition of decorating the graves of Confederate soldiers began during the Civil War. The Memorial Day observance in the North grew out of these customs. General John A. Logan is credited with naming May 30 as Memorial Day. In 1868, he ordered all Grand Army of the Republic posts to decorate the graves of Union soldiers on May 30. RAYMOND HOYT JAHN

See also MEMORIAL DAY.

CONFEDERATE STATES OF AMERICA was the name taken by six southern states when they organized their own government at Montgomery, Ala., in February, 1861. The states *seceded* (withdrew) from the government of the United States in 1860 and 1861 because they feared that the election of Abraham Lincoln, a Republican President, might lead to restrictions on their right to do as they chose about the question of Negro slavery. The first state to leave the Union was South Carolina on Dec. 20, 1860. Mississippi, Florida, Alabama, Georgia, and Louisiana followed South Carolina's lead in January, 1861. In March, 1861, Texas also seceded, and later in that year Virginia, Arkansas, North Carolina, and Tennessee joined the ranks to make 11 Confederate States of America in all.

The idea of a state leaving the Union was not new, and the South did not invent it. Throughout the United States, persons who believed in the doctrine of states' rights had long argued that a state had a right to withdraw from the Union whenever it chose. They argued that individual states had formed the Union and therefore could also dissolve it. Some persons in the New England states wanted to leave the Union during the War of 1812, because the war was unpopular there.

Government. Organization of a government for the Confederacy began on Feb. 4, 1861, when delegates from six of the seven seceding states met at Montgomery, Ala., and set up a temporary government. Jefferson Davis of Mississippi was elected President of the Confederacy, and Alexander H. Stephens of Georgia was chosen Vice-President. Both were to serve for one year. After the adoption of a permanent constitution, they were elected to six-year terms. Six prominent Southerners became members of the first Cabinet, and Montgomery was named the temporary capital. After Virginia seceded, the Confederate Congress voted on May 21, 1861, to move its capital to Richmond. The move was accomplished on May 29.

The Constitution of the Confederacy, adopted in March, 1861, was modeled after the United States Constitution. But it contained six important differences:

1. The term of the President and Vice-President was six years. The President was not allowed to succeed himself.

2. Cabinet members received seats in Congress and had the privilege of debate. But they could not vote.

3. Foreign slave trade was ended, but not slavery.

4. Congress was forbidden to make appropriations for internal improvements, to levy a protective tariff, or to give bounties.

5. A two-thirds vote of both houses of Congress was necessary to admit a new state into the Confederacy or to make appropriations not requested by the heads of departments through the President.

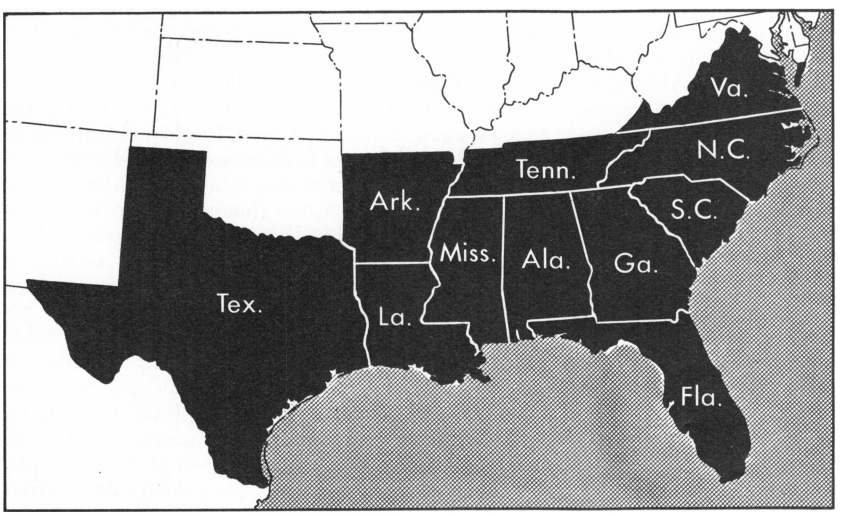
6. The President could veto single items in appropriation bills.

The Confederate States hoped for a peaceful withdrawal from the Union. A number of persons in the Confederacy and in the Union worked hard to avoid war. But their efforts failed, and war began with the attack on Fort Sumter on April 12, 1861.

The Border States were the slave states that lay between the North and the deep South. When the war began, both the Union and the Confederacy made strong efforts to gain their support. North Carolina, Virginia, Arkansas, and Tennessee joined the Confederacy. Delaware, Maryland, Kentucky, and Missouri stayed in the Union. But the western counties of Virginia seceded from the South later in the war, and formed the state of West Virginia. And secessionist groups set up separate state governments in both Kentucky and Missouri, even though these states stayed in the Union. These groups also sent delegates to the Confederate Congress. This accounts for the 13 stars in the Confederate flag even though only 11 states actually joined the Confederate States of America.

Foreign Relations. Great Britain, France, The Netherlands, Spain, and Brazil were among the countries that recognized the Confederate States as a belligerent, but not as a nation. Recognition of southern belligerency meant that Confederate ships received the same privileges granted to vessels of the United States in foreign ports or on the high seas.

The Confederacy suffered great financial disadvantages. The wealth of the nation, before secession, lay mainly in the North, and the South lacked adequate resources for taxation. The Confederate government had



The Confederate States of America was formed by 11 states during the Civil War.

CONFEDERATE CABINET

Secretary of State	Robert Toombs (1861)
	Robert M. T. Hunter (1861)
	Judah P. Benjamin (1862)
Secretary of the Treasury	Christopher Memminger (1861)
	George A. Trenholm (1864)
Secretary of War	Leroy P. Walker (1861)
	Judah P. Benjamin (1861)
	George W. Randolph (1862)
	Gustavus Smith (Acting)(1862)
	James A. Seddon (1862)
	John C. Breckinridge (1865)
Secretary of the Navy	Stephen R. Mallory (1861)
Postmaster General	John H. Reagan (1861)
Attorney General	Judah P. Benjamin (1861)
	Thomas Bragg (1861)
	Thomas Watts (1862)
	George Davis (1864)

to issue paper money early in the war. This money soon became almost valueless. The people of the Confederate States gave generously to their government, and willingly bought government bonds. But their loyal financial support could not create resources that did not exist within the boundaries of the Confederacy.

Progress of the War favored the Confederacy in the first months. The defeat of the Union forces at Fredericksburg, in December, 1862, led the Emperor of France, Napoleon III, to offer his services as peacemaker between the Union and the Confederacy. The Union rejected this offer. In 1863, the tide began to turn against the Confederacy. The Union armies could get more materials and supplies from the industrial North than the Confederate armies could obtain from the agricultural South. The North kept its army supplied with ammunition, food, and clothing, while the army of the South often lacked these supplies. Union ships blockaded Southern ports. The only way the South could bring in necessary supplies from overseas was to run the blockade. But Southern soldiers fought bravely until there was no longer any hope of victory.

The Confederate Congress met in frequent sessions during the war, mainly to follow the bidding of President Davis, who made free use of his war powers. The Davis government lasted until the fall of Richmond, on April 3, 1865. Danville, Va., served as the capital after the fall of Richmond. When the Army of Northern Virginia surrendered on April 9, 1865, the Confederate States of America came to an end. The men of the Confederacy defended to the best of their ability a way of living that to them seemed right. But they yielded to superior force. The road to reunion in spirit between the North and the South was long and hard, but by the beginning of the 1900's resentment and ill will had been largely forgotten. JOHN DONALD HICKS

Related Articles. See the History sections of the articles on the states of the Confederacy. See also:

Benjamin, Judah P.
Border State
Breckinridge, John C.
Civil War
Confederate Memorial Day
Davis, Jefferson
Emancipation Proclamation
Flag (Flags of the United States)
Fort Sumter
Gordon, John Brown
Johnston, Joseph Eggleston
Lee, Robert E.
Mallory, Stephen R.
Memminger, Christopher G.
Nullification
Randolph (George W.)
Seddon, James A.
Semmes, Raphael
States' Rights
Stephens, Alexander H.
Walker, Leroy P.
West Virginia (History)

CONFEDERATE VETERANS, UNITED, was an organization of men who fought for the Confederate States of America during the Civil War. It was founded in 1889 in New Orleans to preserve the friendships formed during the war, and to help Confederate Civil War veterans, their widows, and their orphans.

CONFEDERATION. See ARTICLES OF CONFEDERATION; CANADA, HISTORY OF (Confederation).

CONFESSION, in religion. See ALTAR; ROMAN CATHOLIC CHURCH (Penance).

CONFIRMATION is a religious ceremony practiced by several faiths. In the Roman Catholic, Eastern Orthodox, and Lutheran churches, and in the Church of England, it is associated with baptism. Roman Catholics believe that it confers the grace of the Holy Spirit on baptized persons. During confirmation in Protestant and Roman Catholic churches, the baptized renew and confirm the promises made for them at baptism. In Judaism, boys are confirmed at the age of 13 in a ceremony called *bar mitzvah.* Some temples have similar ceremonies for girls called *bas mitzvah.* Many also hold a confirmation exercise on Shabuot (see SHABUOT). BERNARD RAMM

See also BAPTISM; BAR MITZVAH; BAS MITZVAH.

CONFLICT OF INTEREST occurs if an individual has a financial or other interest in a company doing business with his employer. For example, a person working for a government agency that awards contracts to private industry may have a financial interest in a company bidding for these contracts. A conflict of interest occurs if the government employee favors the company in which he has an interest. The conflict-of-interest issue often arises when businessmen take positions in government. Full-time government employees are required to give up all outside financial interests that might conflict with their official duties. ROBERT A. DAHL

CONFUCIANISM is a philosophy based on the ideas of the Chinese philosopher Confucius. It originated about 500 B.C. From the 100's B.C. to the A.D. 1900's, Confucianism was the most important single force in Chinese life. It influenced Chinese education, government, and attitudes toward correct personal behavior and the individual's duty to society.

Many people consider Confucianism a religion. But Confucianism has no clergymen and does not teach the worship of a God or gods or the existence of a life after death. Confucianism can more accurately be considered a guide to morality and good government.

Early Confucianism. Confucius was born about 551 B.C. At that time, constant warfare raged among the many states that made up China. Rapid political change altered the structure of Chinese society, and many people no longer respected the established standards of behavior. Confucius feared that this threat to orderly social life would lead to the destruction of civilization.

Confucius believed his society could be saved if it emphasized sincerity in personal and public conduct. The key to orderly social life was the gentleman. Confucius defined a gentleman not as a person of noble birth, but as one of good moral character. A gentleman was truly reverent in worship and sincerely respected his father and his ruler. He was expected to think for himself, guided by definite rules of conduct. Confucius included many of these rules in sayings. For example, Confucius taught a version of the golden rule—"What

you do not wish for yourself, do not do to others" (see GOLDEN RULE). A gentleman also studied constantly and practiced self-examination. He took, as Confucius said, "as much trouble to discover what was right as lesser men take to discover what will pay."

Confucius believed that when gentlemen were rulers, their moral example would inspire those beneath them to lead good lives. Virtuous behavior by rulers, he declared, had a greater effect in governing than did laws and codes of punishment.

When Confucius died about 479 B.C., he was largely unknown. His followers spread his ideas. The most important early Confucian philosophers were Mencius (372?-289? B.C.) and Hsün-tzu (mid-200's B.C.). Mencius believed that men were born good. He stressed the need to preserve "the natural compassion of the heart" that makes men human. Mencius emphasized the past as an ideal age and a model for examining present problems. In contrast, Hsün-tzu believed that men could be good and live together peacefully only if their minds were shaped by education and clear rules of conduct.

By about 200 B.C., the first large, unified Chinese empire had begun. The rulers approved of Confucianism's emphasis on public service and respect for authority. In 124 B.C., the government established the Imperial University to educate future government officials in Confucian ideals. The university based its teachings on five books of Confucian thought called the *Five Classics*. Mastery of the *Classics* became proof of moral fitness and the chief sign of a gentleman.

Later Confucianism. The early Confucianists concerned themselves primarily with the needs of society. However, ideas from Taoism and other philosophers helped shift the emphasis to additional areas of human experience. For example, man's ability to live in harmony with nature was a minor issue to Confucius. But it became an important theme in Confucian thought during the 200's and 100's B.C.

From about A.D. 200 to 600, interest in Confucianism declined in China. Many Chinese turned instead to Buddhism and Taoism. These religions dealt with problems of human existence that Confucianism largely ignored, such as the meaning of suffering and death.

A revival of interest in Confucius' philosophy began in the 600's. By the 700's, candidates for government jobs had to take a civil service examination based on Confucian ideas. The examination carried out Confucius' belief that an enduring state must be built on the merit of its rulers' advisers.

Chu Hsi (1130-1200) became a leader of a movement called *Neo-Confucianism*. Chu developed a branch of Neo-Confucianism called the *rational wing*. It emphasized study and investigation of *Li*, the pattern behind human and natural relationships. Scholars led by Wang Yang-ming (1472-1529) developed the *intuitional wing* of Neo-Confucianism. They sought enlightenment by meditating on the nature of their own minds.

Confucianism continued to actively influence Chinese life until it came into conflict with Western ideas, especially Communism, in the 1900's. Today, the Chinese government opposes Confucianism because the philosophy encourages people to look to the past rather than to the future. Confucian ideas remain widespread in other countries in East Asia. N. SIVIN

See also CONFUCIUS.

CONFUCIUS, *kuhn FYOO shuhs* (551?-479? B.C.), was the most influential and respected philosopher in Chinese history. From the 100's B.C. to the A.D. 1900's, his ideas served as the single strongest influence on Chinese society. These ideas, called *Confucianism*, stress the need to develop moral character and responsibility.

Detail of an ink portrait on silk (1600's) by Tanyū; Museum of Fine Arts, Boston

Confucius

Chinese governments made Confucius' teachings the official state philosophy. Millions of people in China—and in such nearby countries as Japan, Korea, and Vietnam—honored Confucius in much the same way as other peoples honor founders of religions. For details of the philosophy of Confucius, see CONFUCIANISM.

Confucius was born in the duchy of Lu, in what is now Shantung Province, China. His real name was K'ung Ch'iu. The name *Confucius* is a Latin form of the title *K'ung-fu-tzu*, which means *Great Master K'ung*. Confucius' parents died when he was a child. He failed in an attempt to become an adviser to a wise ruler. Confucius had wanted the position so he could put into practice his ideas for reforming society. Confucius received some minor official appointments, but at his death he was largely unknown throughout China. His disciples spread his teachings.

No book exists that was definitely written by Confucius. His conversations and sayings were recorded by his disciples in a book called the *Analects*. N. SIVIN

CONGENITAL DISLOCATION. See DISLOCATION.

CONGLOMERATE. See ROCK (Clastic Sediments; picture).

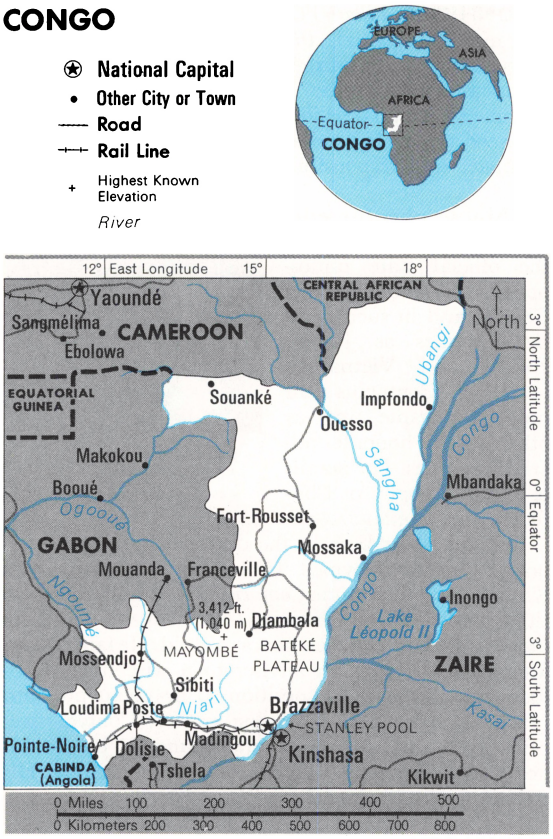
CONGLOMERATE, in business, is a corporation that controls a number of companies in largely unrelated fields. At first, a conglomerate's growth depends more on acquiring new companies than on increasing the profits of its present holdings. Then the corporation tries to make each of its companies a growing and profitable enterprise through better management, greater capital resources, and the common use of facilities.

Because a conglomerate has holdings in various industries, it hopes to balance temporary declines in one industry with advances in another. This diversity also allows the conglomerate to expand without violating monopoly or antitrust laws.

The number of conglomerates in the United States has increased greatly since the early 1960's. Some businessmen and economists believe that this increase threatens the American economic system. They fear that the many competing single-industry companies in the United States will be replaced by a small number of billion-dollar industrial complexes. Other experts argue that conglomerate expansion does not seriously threaten competition because no conglomerate controls the market of an entire industry. LEONARD S. SILK

See also MONOPOLY AND COMPETITION; CORPORATION.

CONGO



WORLD BOOK map

CONGO is a hot, humid country in west-central Africa. The equator runs through the country. Thick forests of trees and tangled bushes and vines cover over half of Congo. Only wild animals live in much of this part of the country. Congo is slightly larger than New Mexico and it has slightly more people than that state.

Congo was once a territory in French Equatorial Africa, and it was called Middle Congo. It became independent in 1960. Its name in French, the official language, is RÉPUBLIQUE POPULAIRE DU CONGO (PEOPLE'S REPUBLIC OF THE CONGO). Brazzaville is the country's capital and largest city.

Congo has few valuable minerals, and most of its soil is poor. But the country is a transportation center. Pointe-Noire, on the Atlantic coast, is an important port. Gabon and the inland countries of the Central African Republic and Chad use this port for some overseas trade.

Government. Congo is a republic. According to the Constitution adopted in 1973, the Congo's president is chief of state. He serves as chairman of the Council of State, the chief executive body of the government. Congo has a one-house legislature, called the People's National Assembly. Congolese voters elect the 115 members of the assembly. The Council of Ministers, headed by the prime minister, carries out the decisions of the Council of State and the People's National Assembly. Elected councils handle local government affairs.

People. Most of the country's 1,070,000 people live either on the southern border near Brazzaville, or on the coast in and around Pointe-Noire. Pointe-Noire and Dolisie are other important cities.

The people belong to four main groups: (1) the Kongo, (2) the Batéké, (3) the M'Bochi, and (4) the Sangha. Each of these groups is composed of several tribes. About 45 of every 100 persons belong to the Kongo group, farmers who live west and southwest of Brazzaville. About 20 of every 100 belong to the Batéké group, hunters and fishermen who live north of Brazzaville. About 10 of every 100 are M'Bochi. The M'Bochi were once fishermen, but many of them now work as clerks and technicians in the towns. The Sangha live in the northern forests.

About half the people practice *fetish* religions. They believe that all things, even lifeless objects such as stones, have spirits. About 4,500 are Moslems, and most of the rest are Christians.

Most of the older Congolese cannot read or write, but about 75 of every 100 children now receive some elementary education. The Center of Administrative and Advanced Technical Studies in Brazzaville offers higher education to Congolese and to students from the Central African Republic, Chad, and Gabon.

Land. Congo covers 132,047 square miles (342,000 square kilometers) and includes six geographical regions: (1) the Coastal Plain, (2) the Mayombé Escarpment, (3) the Niari Valley, (4) the Stanley Pool Region, (5) the Batéké Plateau, and (6) the Congo River Basin.

The Coastal Plain extends about 40 miles (64 kilometers) inland from the Atlantic Ocean. There are lagoons near the coast, but the region is generally dry and treeless.

The Mayombé Escarpment, and a series of plateaus rising from 1,600 to 2,600 feet (490 to 790 meters) above

FACTS IN BRIEF

Capital: Brazzaville.

Official Language: French.

Form of Government: Republic. *Head of State*—President.

Area: 132,047 sq. mi. (342,000 km²). *Greatest Distances*—north-south, 590 mi. (950 km); east-west, 515 mi. (829 km). *Coastline*—100 mi. (160 km).

Population: *Estimated 1976 Population*—1,070,000; distribution, 66 per cent rural, 34 per cent urban; density, 8 persons per sq. mi. (3 persons per km²). *Estimated 1981 Population*—1,193,000.

Chief Products: *Agriculture*—bananas, cassava, coffee, palm kernels and oil, peanuts, plantains, rice, rubber, sugar cane, sweet potatoes, yams. *Forestry*—limba, mahogany, okoumé. *Mining*—potash.

Flag: A golden-yellow five-pointed star lies above crossed hammer and hoe in the upper left corner of a red field. Green palm branches surround the star, hammer, and hoe. The flag was adopted in 1970. See FLAG (picture: Flags of Africa).

Money: *Basic Unit*—franc. See MONEY (table: Values).

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sea level, lie inland, behind the coastal plain. River valleys are cut into these forested ridges.

The Niari Valley, a richer farming region, lies beyond the Mayombé Escarpment. It is covered by wooded land and *savannas* (grassy plains).

The Stanley Pool Region, east of the Niari Valley, consists of a series of bare hills. Most of the land there has been cleared for farming. Stanley Pool is a lake formed by the widening of the Congo River.

The Batéké Plateau is a grass-covered elevated plain in the central part of the country. Deep, forested valleys containing tributaries of the Congo River divide it.

The Congo River Basin in the north includes large swampy areas. The Ubangi, the main Congo tributary, forms the country's northeastern border.

Most of Congo has a hot, humid climate, with rainfall throughout the year. Parts of the Congo River Basin have about 100 inches (250 centimeters) of rainfall a year, and temperatures average from 75° to 78° F. (24° to 26° C). The Batéké Plateau averages less than 60 inches (150 centimeters) of rain a year. Temperatures there vary from 70° to 80° F. (21° to 27° C). The coastal area is cooler and drier than the rest of the country, because the cold Benguela ocean current flows along the coast.

Economy. Except for its forests, Congo has few natural resources. It has few industries.

Most of the Congolese raise bananas, corn, rice, and other crops to feed their own families. Lumber is the chief export, and most of it comes from the Mayombé ridges and the northern forests.

Congo has one of the longest transportation systems in Africa. The Congo-Ocean railroad, a 320-mile (515-kilometer) line linking Brazzaville and Pointe-Noire, and its branch line form the only railroad. Boats use the Congo and Ubangi rivers north of Stanley Pool at Brazzaville, but rapids below Stanley Pool prevent boats from getting to or from the ocean. The Congo-Ubangi river system carries goods and passengers as far as Bangui, capital of the Central African Republic, a distance of 700 miles (1,100 kilometers). Most of the exports and imports of the Central African Republic and Chad move over the river system and the Congo-Ocean railroad. Gabon's manganese ore moves over the branch of the railroad. This shipping trade is important to the Congo economy. Building and maintaining roads is difficult because of heavy rains and thick forests.

History. A small part of what is now Congo probably was part of the Kongo kingdom, which flourished during the 1400's and 1500's (see KONGO). Portuguese explorers reached the Congo coast in the 1400's. Portuguese and other European traders bought slaves and ivory along the coast from the late 1400's to the 1800's. But Europeans did not explore the interior of what is now Congo until the late 1800's. Pierre Savorgnan de Brazza, a French explorer, reached the area in 1875. Henry M. Stanley, the famed British explorer, sailed down the Congo River from its source to the ocean in 1876 and 1877 (see STANLEY AND LIVINGSTONE).

In 1880, Brazza and Makoko, the Batéké king, signed a treaty that placed the area on the north side of the Congo River under French protection. This area, then called Middle Congo, became a territory in French Equatorial Africa in 1903. In 1910, it was linked with the territories of Gabon, Chad, and Ubangi-Shari (now the Central African Republic). Middle Congo gained internal self-government in 1958. It became independent on Aug. 15, 1960.

Fulbert Youlou became the first president, but the army and trade unions forced him to resign in 1963. A

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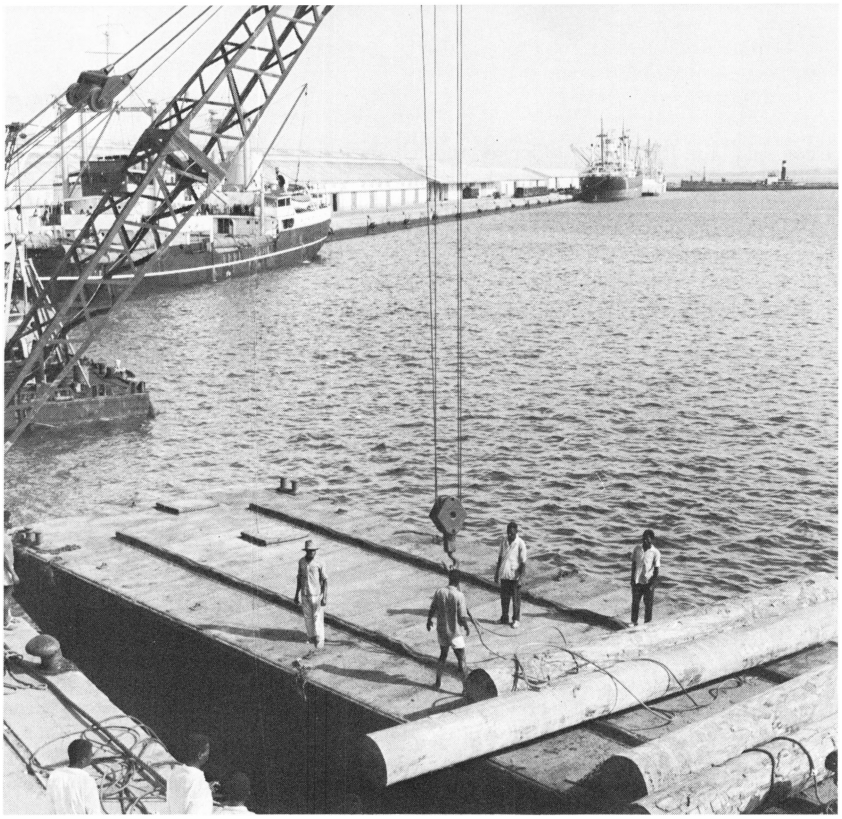
Brazzaville, Capital of Congo, Stands Beside Stanley Pool, on the Congo River.



Dockworkers at Pointe-Noire, the Congo's Atlantic port, prepare to load lumber for export. The port handles some of the foreign trade of several other African nations and helps make shipping an important part of the Congolese economy.

Editorial Photocolor Archives

socialist government then took control, and Alphonse Massamba-Débat became president. The government nationalized industries, and recognized such Communist governments as those of China, North Korea, and North Vietnam. In 1968, military officers led by Major Marien Ngouabi removed Massamba-Débat from office and set up a temporary government. In 1970, a new constitution established a one-party state. Marien Ngouabi became president of the country. A constitution adopted in 1973 provided for a legislature and local government councils. R. J. HARRISON CHURCH

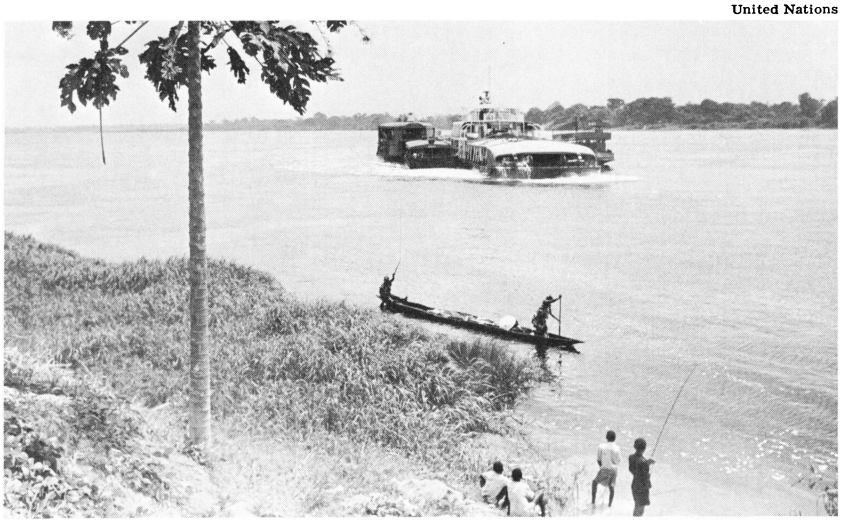
See also BRAZZAVILLE; CONGO RIVER; FRENCH EQUATORIAL AFRICA.

CONGO (KINSHASA). See ZAIRE.

CONGO RIVER is the sixth longest river in the world, and the second largest in the volume of water it carries. It drains an area of about 1,400,000 square miles (3,630,000 square kilometers) in west-central Africa. Ships can travel 1,000 miles (1,600 kilometers) up the Congo's total 2,716 miles (4,371 kilometers). Railway portages provide transportation along the river where rapids obstruct navigation.

The Congo rises in southeastern Zaire. The river is called the Lualaba River at its source, and has many other names before it becomes the Congo just after crossing the equator. Important branches of the

United Nations



The Congo River serves as a major transportation route in west-central Africa. Goods and people travel along the river in large freighters and dugout canoes.

Congo include the Aruwimi and Ubangi rivers from the north and the Lomami and Kasai rivers from the south.

The Congo River widens to form Stanley Pool just before it rushes over some 30 rapids below Kinshasa. The river drops about 800 feet (240 meters) between Kinshasa and Matadi, which lies 90 miles (140 kilometers) from the sea. The Congo has no delta, unlike other African rivers. It empties its muddy waters into the South Atlantic through a deep channel that extends far into the ocean.

Portuguese navigators reached the mouth of the Congo River in 1482. But Europeans knew nothing about its upper course until Henry M. Stanley explored the region between 1874 and 1877. HARRY R. RUDIN

See also RIVER (color chart: Longest Rivers); STANLEY AND LIVINGSTONE; STANLEY FALLS.

CONGREGATION OF THE INDEX. See INDEX LIBRORUM PROHIBITORUM.

CONGREGATIONAL CHRISTIAN CHURCHES merged with the Evangelical and Reformed Church in 1961 to form the United Church of Christ (see UNITED CHURCH OF CHRIST). A few of the congregations of the Congregational Christian Church voted against the merger.

CONGRESS, *KAHNG grihs*, comes from the Latin word *congressus*, which means *a meeting*. Any group of people who represent organizations, regions, or nations, and who meet together to discuss their problems, may be called a congress. In the United States, the word *congress* usually refers to the Congress of the United States. An *international congress* is a conference attended by representatives of various nations. Such a congress may meet either to lay down peace terms at the end of a war, or to settle problems in time of peace. The name *congress* was given to several important international conferences which took place in the 1800's to determine boundaries and arrange political settlements in Europe. The most important of the congresses were as follows:

Congress of Vienna (1814-1815), which divided up Napoleon's empire after the Napoleonic Wars.

Congress of Paris (1856), which settled the problems that grew out of the Crimean War. This congress also was an important step in the growing unity of Italy.

Congress of Berlin (1878), which took away from Russia Balkan land it had won from Turkey during the Russo-Turkish Wars. PAYSON S. WILD

See also BERLIN, CONGRESS OF; CONGRESS OF THE UNITED STATES; CONTINENTAL CONGRESS; VIENNA, CONGRESS OF.

CONGRESS HALL. See PHILADELPHIA (Independence National Historic Park).

CONGRESS OF INDUSTRIAL ORGANIZATIONS (CIO) was an association of labor unions active from 1938 to 1955. In 1955, it merged with the American Federation of Labor (see AMERICAN FEDERATION OF LABOR AND CONGRESS OF INDUSTRIAL ORGANIZATIONS). Most of the CIO unions had members only in the United States, but a few international unions also had chapters, or locals, in Canada. Most of the CIO unions were *industrial unions*, rather than *craft unions*. The CIO organized all workers in a plant into one union rather than just the workers in one particular craft.

The CIO was originally a group called the *Committee for Industrial Organization*. In 1935, eight presidents of AFL unions formed the CIO to carry on an organizing drive in mass-production industries. The CIO signed up unskilled as well as skilled workers. Some AFL leaders opposed the idea of industrial unions. But the CIO set up organizing committees and organized industrial unions in steel, automobile, rubber, and other major industries. The AFL did not accept these unions, and expelled unions that had taken part in the CIO. In 1938, the CIO formed its own federation and changed its name to the *Congress of Industrial Organizations*.

In its 1938 constitution, the CIO stated its main purposes as: (1) to organize the unorganized; (2) to improve wages, hours, and working conditions; (3) to establish peaceful labor relations by forming unions strong enough to bargain with large industries; (4) to maintain collective bargaining and wage contracts; and (5) to secure legislation for the welfare of workers.

The Political Action Committee (PAC) of the CIO worked in national politics. State and city industrial councils were active in state and local politics. The CIO supported pro-labor political candidates and legislation in line with its main purposes.

CIO membership grew from about 4 million in 1938 to about 6 million in 1945. In 1949 and 1950, the CIO expelled 11 affiliated unions that it found guilty of being dominated by Communists or by Communist sympathizers.

After many attempts at a merger, the CIO and AFL finally united in 1955. By then, the craft vs. industrial union conflict had become less important. More than half of the AFL's members were in industrial unions. Rivalry among labor leaders lessened after the deaths in 1952 of William Green, president of the AFL, and Philip Murray, president of the CIO. When the two organizations merged, the CIO had about 5,800,000 members, the AFL about 10,200,000. JAMES B. CAREY

See also DUBINSKY, DAVID; HILLMAN, SIDNEY; LABOR (Labor Unions in the U.S.); LEWIS, JOHN L.; MURRAY, PHILIP; REUTHER, WALTER PHILIP.

CONGRESS OF RACIAL EQUALITY (CORE) is a civil rights organization in the United States. It fights discrimination with programs aimed at helping black people gain control of businesses, political offices, schools, and other institutions in black communities.

James Farmer and other civil rights leaders founded CORE in 1942 as a nonviolent group. Members attacked discrimination in housing, public accommodations, and transportation. They used pickets, sit-ins, freedom rides, and *boycotts* (refusal to buy or use certain products or services). CORE conducted drives to register black voters, helped establish Freedom Schools to supplement the education of black children, and set up community centers. In 1966, under Floyd McKissick, CORE rejected nonviolence in favor of militant self-defense. Roy Innis became director in 1968. National headquarters are at 200 West 135th Street, New York, N.Y. 10030. M. CARL HOLMAN

CONGRESS OF THE CONFEDERATION, established by the Articles of Confederation, operated the United States government from Mar. 1, 1781, to Mar. 4, 1789. It replaced the Continental Congress, although many persons continued to call it that. The Congress of the Confederation was replaced by the Congress established by the United States Constitution. See also ARTICLES OF CONFEDERATION; CONTINENTAL CONGRESS.

CONGRESS OF THE UNITED STATES

CONGRESS OF THE UNITED STATES is the lawmaking branch of the federal government. Its legal name is THE CONGRESS, but most people call it simply CONGRESS. Its most important task is making laws. But Congress does much more than make laws. For example, Congress plays an important part in amending the United States Constitution. Congress also conducts investigations. In addition, it reviews the work of the executive and judicial branches of the federal government.

Congress is closer to the American people than is either the executive or the judicial branch of the government. The people elect the members of Congress directly. Each member of Congress tries to serve and to reflect the desires of his *constituents* (the voters he represents). The people elect the President only indirectly, through the Electoral College (see ELECTORAL COLLEGE). They do not elect any federal judges.

How Congress Is Organized

Congress is a *bicameral* (two-house) legislature. It consists of the 100-member *Senate* and the 435-member *House of Representatives* (usually called simply the *House*). All members of Congress are *congressmen*. But this term usually refers only to members of the House. In each house, the party with the most members is called the *majority party*. The party with the least members is called the *minority party*.

The Senate. The *formal* (official) organization of the Senate is given in Article I, Section 3 of the Constitution (see CONSTITUTION OF THE UNITED STATES). The Vice-President of the United States is the formal head of the Senate. He has the title of *President of the Senate*. The Senate elects one of its members from the majority party to be *president pro tempore* (temporary president). He presides whenever the President of the Senate is absent. Other officials of the Senate include the secretary, sergeant at arms, chief clerk, chaplain, secretary for the majority party, and secretary for the minority party. These officials are not senators.

The organization of the Democratic and Republican parties in the Senate is called the *informal* (unofficial) organization of the Senate. This organization is not mentioned in the Constitution. The leaders of the Democratic and Republican parties are chosen by their parties in a party *caucus* (conference). The senators of each party elect a *floor leader* who is his party's chief officer in the Senate. Each party also elects a *whip*, who ranks second to the floor leader. See SENATE (The United States Senate).

The House of Representatives, like the Senate, has both a formal and an informal organization. The formal organization of the House is specified in Article I, Section 2 of the Constitution. The presiding officer is the *speaker of the House*. The majority party nominates the

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United Press Int.

speaker, and the entire House elects him. Nonmember officials of the House include the clerk, sergeant at arms, doorkeeper, postmaster, and chaplain.

Informal organization is more significant in the House than in the Senate. The membership of the House is much larger than that of the Senate. One Representative cannot influence the House as greatly as one senator can influence the Senate. Each representative must work closely with his fellow party members to accomplish his party's program. Party policy is set in caucuses. Each party has a floor leader and a whip. See HOUSE OF REPRESENTATIVES.

Agencies Under Congress. Six government offices report directly to Congress. These are (1) the Architect of the Capitol, (2) the Botanic Garden, (3) the Congressional Budget Office, (4) the General Accounting Office, (5) the Government Printing Office, and (6) the Library of Congress.

When Congress Meets. A new Congress comes into existence every two years upon the election of a new House of Representatives. About a third of the Senate comes up for election every two years. The Senate is called a *continuing body* because there is never a completely new Senate. Beginning with the first Congress (1789-1791), regular sessions of Congress have been numbered consecutively.

Congress holds one regular session each year. Regular sessions begin on January 3 unless Congress sets a different date. They usually end on July 31, but Congress can change this date also. In even-numbered years, Congress usually adjourns in early summer. An early adjournment gives senators and representatives time to campaign for re-election. In odd-numbered years, Congress sometimes does not adjourn until midsummer or late summer. After Congress has adjourned, the President can call a *special session*. The President can adjourn Congress only when the two houses cannot agree on an adjournment date.

The Senate and the House usually meet separately. They occasionally meet together in a *joint session* in the chamber of the House of Representatives. The Constitution requires Congress to hold a joint session to *canvass* (examine) the electoral votes after a presidential election. Both houses also meet together when the President addresses Congress in person. No legislation can be *enacted* (passed into law) at a joint session.

How Congress Makes Laws

The Power to Legislate. The Constitution gives Congress all the lawmaking powers of the federal government. But it does not give all these powers in the same way. The *expressed powers* of Congress are listed in Article I, Section 8 of the Constitution. These powers are the most important ones. They deal with such subjects as taxation, borrowing money, and declaring war. Other expressed powers concern foreign and domestic commerce, national defense, coinage, weights and measures, and the courts.

The *implied powers* are not listed in the Constitution. But Article I, Section 8 of the Constitution says that Congress can pass all laws that are "necessary and proper" for carrying out the expressed powers. Congress has the expressed power to pass tax laws. It has the implied power to set punishments for persons who break the tax laws. Through the years, authorities have argued over what action could be properly implied.

Other powers of Congress do not come from the Constitution. Congress has these *inherent powers* because the United States is a *sovereign* (independent) nation. For example, some authorities say that Congress uses its

FACTS IN BRIEF ABOUT CONGRESSMEN

Number: The Senate has 100 members, and the House of Representatives consists of 435 members.

Qualifications: A candidate for the Senate must be: (1) at least 30 years old, (2) a citizen of the United States for at least 9 years, and (3) a resident of the state from which he seeks election.

A candidate for the House of Representatives must be: (1) at least 25 years old, (2) a citizen of the United States for at least 7 years, and (3) a resident of the state from which he seeks election.

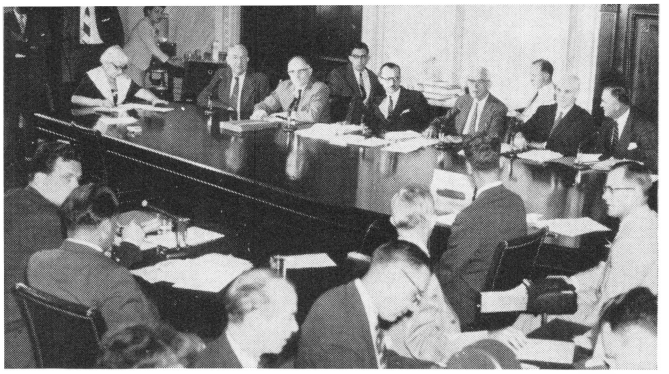
Nomination: Candidates for Congress are nominated by primary election or by party convention.

Election: A senator is elected by the voters from all parts of his state. A representative may (1) be elected by the voters of one congressional district of his state, or (2) be elected *at large* (by voters throughout the state).

Term: Senators are elected to six-year terms, and representatives are elected to two-year terms. A member of Congress can serve an unlimited number of terms.

Income: Every member of Congress receives a salary of $42,500 a year. Members also receive free office space and allowances for office expenses, staff salaries, travel, and similar expenses.

Removal from Office: Members of Congress may be expelled by a two-thirds vote of their house.



Wide World

Congressional Committees often hold hearings on matters connected with bills they are considering. The committees may call witnesses to answer questions and give information. This helps the congressmen decide what action to take on the bills.

inherent powers when it grants or cancels a person's citizenship, or when it prevents undesirable persons from entering the country. See SOVEREIGNTY.

Congress is limited in the way that it uses its powers. For example, the Supreme Court can rule that an act of Congress violates the Constitution. If the court declares an act unconstitutional, the act is no longer the law of the land, unless the court later reverses its decision. See SUPREME COURT OF THE UNITED STATES (Authority of the Supreme Court). The Constitution also limits Congress by prohibiting it from taking certain actions. Congress cannot change state boundaries or state constitutions. Nor can it deny *due process of law* to individuals (see DUE PROCESS OF LAW). Finally, Congress is limited by the power of public opinion. Members of Congress know their actions must reflect the general will of the people.

The Committee System. Committees of Congress do most of the work of preparing legislation. The House has 22 *standing* (permanent) committees and the Senate has 18. There are also four other kinds of committees: (1) *subcommittees* of the standing committees; (2) *special* and *select* committees, appointed for a limited time or purpose; (3) *joint* committees made up of members of both houses; and (4) *commissions* and *boards* that handle various other matters.

Democrats and Republicans in each house have special committees that nominate members of the standing committees. All the members of each house then choose the committee members from among the nominees. Both Democrats and Republicans serve on each committee. But the majority party has a majority of the members of every committee.

From 1910 until 1975, the chairmen of all committees were selected by a custom called the *seniority system*. Under this system, the senator or representative from the majority party who had been on the committee longest was automatically elected chairman. Many chairmen came from a state where one party was much stronger than the other. They were elected time after time and built up great seniority. Critics of the system claimed that it rewarded length of service, not ability or party loyalty.

In 1975, the House elected five chairmen who were not the most senior member of their committee. Many political experts considered these elections the end of the seniority system.

In both houses of Congress, nearly every *bill* (piece of legislation) goes before a standing committee for action. The committees can take one of three actions: (1) *report* (recommend) a bill favorably in its original form, (2) report the bill with proposed changes, or (3) *pigeonhole* (fail to report) the bill.

Passing a Bill. After a bill has been reported by a committee, it is placed on the *legislative calendar* of the house that is considering it. The calendar shows the order in which bills have been reported by committees. The House has separate calendars for the two types of bills it considers: (1) public bills and (2) private bills. *Public bills* deal with matters of general concern, such as taxation, national defense, and foreign affairs. *Private bills* deal with specific places, groups, or persons, such as paying damages to a man who was hit by a government-owned truck. The Senate puts all bills on the same legislative calendar. The Senate also has an *executive calendar* that includes executive actions such as treaties and presidential nominations.

In both houses, a *simple majority vote* (one more than half) is enough to pass most bills. On major matters, the Senate takes a *roll call vote*. Each senator says "Aye!" or "Nay!" when his name is called. The House of Representatives uses an electronic voting system. With this system, each member votes by pushing a button. Electronic equipment records and counts the votes. On a few matters, the House uses a method called a *voice vote*. All in favor say "Aye!" and then all opposed say "Nay!"

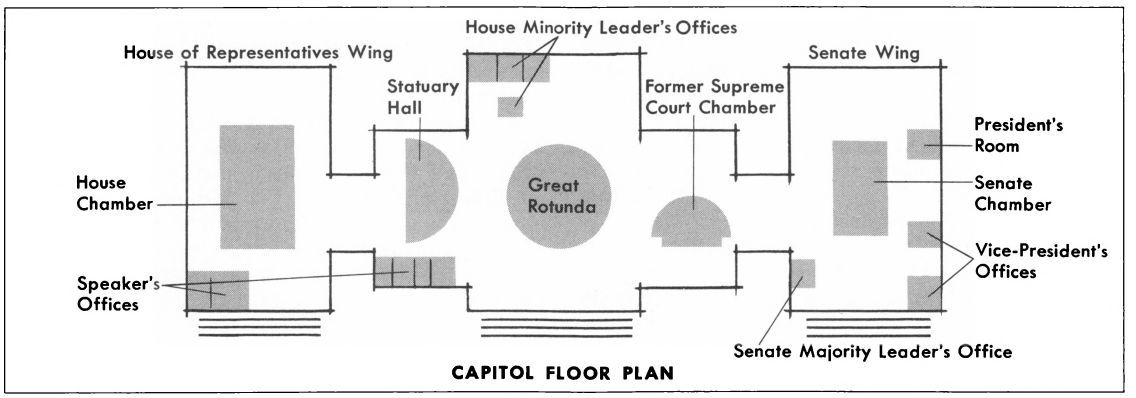
Before the President can sign a bill, both houses of Congress must pass it in identical form. If the House and the Senate pass different versions of the same bill, a special *conference committee* tries to settle the differences. Five representatives and five senators serve on most of these committees, but the number often varies. The presiding officer in each house appoints the members who are to serve on the conference committee.

Congress can enact a bill even if the President vetoes it. The vetoed bill becomes law if, after the President's veto, the Senate and the House repass it by a two-thirds

STANDING COMMITTEES OF CONGRESS

Senate	House of Representatives
Aeronautical and Space Sciences	Agriculture
Agriculture and Forestry	Appropriations
Appropriations	Armed Services
Armed Services	Banking, Currency, and Housing
Banking, Housing, and Urban Affairs	Budget
Budget	District of Columbia
Commerce	Education and Labor
District of Columbia	Foreign Affairs
Finance	Government Operations
Foreign Relations	House Administration
Government Operations	Interior and Insular Affairs
Interior and Insular Affairs	Interstate and Foreign Commerce
Judiciary	Judiciary
Labor and Public Welfare	Merchant Marine and Fisheries
Post Office and Civil Service	Post Office and Civil Service
Public Works	Public Works and Transportation
Rules and Administration	Rules
Veterans' Affairs	Science and Technology
	Small Business
	Standards of Official Conduct
	Veterans' Affairs
	Ways and Means

WORLD BOOK photo by Air Photographics, Inc.



WORLD BOOK diagram

The Buildings Where Congress Works include the United States Capitol (1), the House office buildings (2), and the Senate office buildings (3). The floor plan shows the layout of the Capitol. The House of Representatives wing includes the House Chamber, *left,* the room in which the House meets. The Great Rotunda, *center,* is the circular area under the Capitol dome. The Senate wing includes the Senate Chamber, *right,* where the Senate meets.

majority of those members voting. See UNITED STATES, GOVERNMENT OF THE (How a Bill Becomes Law).

Other Duties of Congress

Congress has six major nonlegislative duties. These deal with (1) amending the Constitution, (2) conducting investigations, (3) reviewing the operations of the executive branch, (4) *canvassing* (examining) electoral votes, (5) determining presidential disability, and (6) impeaching and trying federal officials.

Amending the Constitution is the most important nonlegislative power. Congress may propose amendments, or else it may call a constitutional convention to propose them when two-thirds of the states make a formal request. Congress usually indicates whether the states must vote on a proposed amendment (1) by state legislatures or (2) by special state conventions.

Conducting Investigations. Congress can investigate any subject that affects any of its powers. Under its power to declare war, for example, Congress can investigate groups that might be harmful to the United States.

The entire House or the entire Senate can conduct an investigation. But congressional committees usually do so. An investigating committee can call witnesses and require them to produce information. The House or the Senate can give its committees the power to issue warrants for the arrest of persons who do not obey congressional orders. Congress can punish these persons for *contempt,* but usually the courts try contempt cases and prescribe penalties (see CONTEMPT).

Reviewing Government Actions. Congress has a constant influence on the operations of the executive branch of the government. Congress *appropriates* (sets aside) money for the executive departments, and can call on department heads to explain their budgets. Congressional committees also can investigate the activities of federal agencies. Also, if the office of Vice-President becomes vacant, the President names a new

Vice-President, who must be confirmed by Congress.

The Senate has an especially strong check on two powers of the President. The Constitution requires that the Senate must (1) approve all treaties made by the President and (2) give its advice and consent when the President appoints certain government officials. These officials include ambassadors, justices of the Supreme Court, Cabinet and sub-cabinet officers, federal district judges, federal district attorneys, and marshals. If a senator objects to an appointee from his home state, the Senate seldom approves the appointment. This custom is called *senatorial courtesy*.

Canvassing Electoral Votes. Congress must check the official outcome of every presidential election. After the Electoral College has voted, Congress canvasses the results and announces the vote. In most elections, these actions are largely ceremonial. The public knows the winner long before Congress makes the official announcement. If no candidate wins a majority of the electoral votes, the House elects the President and the Senate elects the Vice-President. See ELECTORAL COLLEGE (The College in Action).

Determining Presidential Disability. A disabled President must turn over the duties of his office temporarily to the Vice-President. If the President refuses, Congress may appoint a commission to determine whether the President is able to discharge his duties. Later, if the President declares he is again fit for office, and the commission disagrees, Congress has the power to decide the issue. See CONSTITUTION OF THE UNITED STATES (Amendment 25).

Impeaching and Trying Federal Officials. Congress seldom uses this power. When an impeachment does take place, the House brings the impeachment charges against the accused official. The Senate then tries him. See IMPEACHMENT.

A Member of Congress at Work

Responsibilities of His Office. During sessions, most members of Congress use the morning hours to take care of office work, to meet visitors, and to attend committee meetings. Most senators and representatives serve on two standing committees. They may also serve on subcommittees and special committees.

Senate and House sessions usually begin at noon and last through the afternoon. Sometimes they extend into the evening. But the legislator usually spends little time at these sessions. A bell signal in his office calls him for debates or votes.

Telephone calls, letters, and visits—many of them from constituents—take up a great deal of the legislator's time. Many persons who contact a member of Congress want to give their views on various bills. Others inquire about jobs, contracts, passports, immigration, or appointments to the military academies.

Every legislator has assistants to aid him in his work. A senator receives an allowance to hire an office staff. This staff usually includes two or three legislative and administrative assistants and several secretaries. Representatives receive smaller allowances. A representative's staff usually consists of three or four secretaries. The speaker of the House and representatives with special duties have additional aides.

The Old House of Representatives, an oil painting; Corcoran Gallery of Art, Washington, D.C.

The House of Representatives met by gaslight during the early 1800's. Samuel F. B. Morse, who later developed the telegraph, painted the House as it met during its 1821-1822 session.

Congressional Travel. Most members of Congress have an office both in their home town and in Washington, D.C. Legislators often travel home to talk with voters, to study local problems, to talk with party leaders, or to plan campaign strategy. Trips home are especially important when a legislator is seeking renomination or reelection. Congressmen receive an allowance for several round trips to their district each session.

Members of Congress also travel to campaign for others, to attend meetings, and to make public speeches. They often have to travel as part of their committee work. The Senate and House sometimes send members on distant trips to gather information or to take part in ceremonies. Critics refer to such trips as *junkets*. The critics suggest that many legislators make these trips only to enjoy travel at public expense. Congressmen argue that experience gained by traveling helps them legislate wisely and save the taxpayers' money.

Social Responsibilities. Members of Congress and their families attend many important ceremonies. These include the President's inauguration, the ritual of swearing in new members of Congress, and various ceremonies honoring national heroes and events. A legislator also meets important visitors from other countries and attends official parties and receptions.

Many *lobbyists* (persons who try to influence legislators) try to have frequent social contacts with members of Congress. They try in this way to persuade legislators to favor a group or a cause. Legislators must be careful to avoid accepting any favors that could be interpreted as bribes. See LOBBYING.

History of Congress

Early Days. The First Continental Congress was the country's first national legislature. It met in Philadelphia in 1774. The Second Continental Congress, which met in Philadelphia in 1775, governed during most of the Revolutionary War. It operated until 1781, when the Congress of the Confederation was formed. Many persons continued to use the name Continental Congress when referring to the legislature. The Continental Congresses and the Congress of the Confederation were *unicameral* (one-house) legislatures. See CONTINENTAL CONGRESS; ARTICLES OF CONFEDERATION.

In 1787, a Constitutional Convention met to strengthen the national government. The convention

delegates had many problems. One of the most difficult was the need to compromise the conflicting demands of small and large states. The small states feared that the large states would dominate them. They insisted that all states should have equal representation in the national legislature. But the large states, with more people, thought this would be unfair. The solution, known as the *Connecticut Compromise*, provided for a two-house legislature. In one house (the Senate), each state received equal representation. In the other (the House), representation was based on population. See CONSTITUTION OF THE UNITED STATES (The Constitutional Convention).

Reforms in Congress. Although Congress has grown much larger, its form has changed little. Amendments 17 and 20 to the Constitution made important changes. Amendment 17, in 1913, gave the people the right to elect senators. Previously, senators had been elected by state legislatures. Amendment 20, in 1933, abolished the lame duck session (see LAME DUCK AMENDMENT).

Disputes have raged over many other features of Congress. One of the most stirring arguments concerned the power of the speaker of the House. This dispute came to a climax in 1910, when Joseph G. Cannon (1836-1926) of Illinois was speaker. Until then, the speaker had appointed all House committees. As a result, he had almost complete control over the House. In 1910, the House adopted a resolution that gave the entire House the power to appoint committees.

In 1946, Congress passed the Legislative Reorganization Act. This act increased the efficiency of Congress. Among other actions, it cut the number of standing committees and gave Congress greater control over lobbying. In 1955, the House adopted new rules for investigating committees. These rules provided added protection for the civil liberties of witnesses.

In 1964, the Supreme Court of the United States ruled that all congressional districts must be "substantially" equal in population. This decision was directed at the problem of *apportionment* (distribution) of House members. In the past, a rural district with 250,000 persons and an urban district with 500,000 persons might each elect one representative. This meant that the citizens in the rural district had greater representation than those in the urban district. After the 1964 decision, several states changed the boundaries of their districts so that all their House members represented nearly equal numbers of persons.

Unsolved Problems still exist. One such problem is to improve the cooperation between the President and Congress. This issue becomes particularly difficult when the President belongs to one political party, and the majority of legislators belong to the other party.

Another problem is *gerrymandering* (shaping legislative districts in an unfair way). Federal regulations might discourage state legislatures from this practice. See GERRYMANDER.

Some critics claim that members of Congress spend too much time on petty matters, such as private bills. They say the legislators should have more aides to do research and to handle routine work on such matters. Other critics make the following points: (1) Legislators would get more done if the District of Columbia were allowed to govern itself. (2) The Senate could save much time and money if it would outlaw the filibuster (see FILIBUSTERING). (3) The House could pass laws more quickly and easily if it reduced the power of the Rules Committee. (4) The quality and quantity of work done by committees might be improved if Congress appointed chairmen on the basis of ability, not seniority. But regardless of their criticisms, most authorities agree that the Congress of the United States is one of the most successful legislative bodies in the world. These authorities point out that the men and women who have served in Congress have, on most issues, carried out the will of the majority of Americans. JOHN H. FERGUSON

Related Articles. See the articles on HOUSE OF REPRESENTATIVES and SENATE with their *Related Articles*.

Capitol, United States
Congressional Page
Congressional Record
Franking and Penalty Privileges
General Accounting Office
Government Printing Office
Library of Congress
President of the United States
Territory
United States, History of the
United States Botanic Garden

Outline

I. How Congress Is Organized
- A. The Senate
- B. The House of Representatives
- C. Agencies Under Congress
- D. When Congress Meets

II. How Congress Makes Laws
- A. The Power to Legislate
- B. The Committee System
- C. Passing a Bill

III. Other Duties of Congress
- A. Amending the Constitution
- B. Conducting Investigations
- C. Reviewing Government Actions
- D. Canvassing Electoral Votes
- E. Determining Presidential Disability
- F. Impeaching and Trying Federal Officials

IV. A Member of Congress at Work
- A. Responsibilities of His Office
- B. Congressional Travel
- C. Social Responsibilities

V. History of Congress

Questions

Why is Congress the branch of government closest to the people?
Why are there two houses of Congress?
What is a *joint session? Senatorial courtesy?*
What is the role of a congressional committee in passing laws?
How does Congress take part in amending the Constitution?
How does Congress influence the President's treaty-making power?
What are *delegated powers? Implied powers?*
In what ways is the power of Congress limited?
What suggestions do critics make for improving the efficiency of Congress?
What are six nonlegislative duties of Congress?

Reading and Study Guide

See *Congress of the United States* in the RESEARCH GUIDE/INDEX, Volume 22, for a *Reading and Study Guide.*

CONGRESSIONAL COMMITTEE. See CONGRESS OF THE UNITED STATES (The Committee System).

CONGRESSIONAL LIBRARY. See LIBRARY OF CONGRESS.

CONGRESSIONAL MEDAL OF HONOR. See DECORATIONS AND MEDALS (Military Awards).

CONGRESSIONAL PAGE works as a messenger in the United States Senate or House of Representatives. Pages carry messages between the Capitol and the

Senate and House office buildings, and run errands for the senators and representatives. Members of Congress appoint a limited number of young people from their home districts to work as pages. Pages are paid only for the periods the Senate or House is in session. For example, if Congress is in session for 12 months, Senate pages receive $8,160, and House pages receive $7,506. Pages attend a special high school in the Library of Congress. Classes meet from 6:30 A.M. to 9:45 A.M.

CONGRESSIONAL RECORD is a printed account of what is done and said in Congress daily. Each member of Congress finds on his desk in the morning a copy of the *Record* for the day before. The *Congressional Record* prints everything said in Congress, except during executive sessions of the Senate. Congressmen may make changes in their speeches before they are printed in the *Record*. The congressmen also can have material other than speeches before Congress printed in the *Record*.

A printed account of what happens in Congress has been published since 1799. Up to 1824, it was known as the *Annals of Congress*, and from 1825 to 1837 as the *Register of Debates*. In 1837 the *Congressional Globe* was first printed. The present *Congressional Record* was started in 1873. The *Record* is sent free to depository libraries, and anyone may subscribe to it or even buy separate parts of it from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. WILLIAM G. CARLETON

CONGRESSMAN or CONGRESSWOMAN is a member of the U.S. Congress. The term generally refers to a member of the House of Representatives. See ADDRESS, FORM OF; CONGRESS OF THE UNITED STATES.

CONGRESSMAN AT LARGE. See HOUSE OF REPRESENTATIVES (Apportionment).

CONGRESSWOMAN. See CONGRESSMAN.

CONGREVE. See MATCH (History).

CONGREVE, WILLIAM (1670-1729), was an English dramatist who wrote witty, sophisticated comedies. The best of his five plays are *Love for Love* (1695) and *The Way of the World* (1700). They contain lively and clever speeches rather than memorable characters or comic situations. They have a polished prose style and a civilized, realistic view of life. *The Way of the World* presents a satirical picture of a cultured, worldly, high society. The play laughs at hypocrites, boors, would-be wits, fools, and aging coquettes. Congreve's most popular play during his lifetime was *The Mourning Bride* (1697), his only tragedy. It contains the famous line "Music has charms to soothe a savage breast."

Congreve was born in Yorkshire, and grew up in Ireland. He entered law school in London in 1691, but preferred writing and the leisurely life of a man about town. He wrote little after 1700. THOMAS H. FUJIMURA

CONGREVE, SIR WILLIAM (1772-1828), developed the rocket used by British troops in the Napoleonic Wars. By 1808, he had made a weapon lighter, cheaper, and more powerful than the smooth-bore cannon. The rocket was chiefly effective for its noise and glare. The "rockets' red glare" in "The Star-Spangled Banner" refers to these rockets in the War of 1812. Congreve was born in Woolwich, England. ROBERT E. SCHOFIELD

See also ROCKET (Early Rockets).

CONIC PROJECTION. See MAP.

CONIFER. See CONE-BEARING PLANT.

CONJUGATION, *KAHN juh GAY shuhn*, is a complete listing of the forms of a verb by mood, number, person, tense, and voice. A *synopsis* is a summary of these forms in only one person, as shown below for the verb *show*.

INDICATIVE MOOD

Simple Forms

Tense	Active Voice	Passive Voice
Present	it shows	it is shown
Past	it showed	it was shown
Future	it will show	it will be shown
Present Perfect	it has shown	it has been shown
Past Perfect	it had shown	it had been shown
Future Perfect	it will have shown	it will have been shown

Progressive Forms

Tense	Active Voice	Passive Voice
Present	it is showing	it is being shown
Past	it was showing	it was being shown
Future	it will be showing	*
Present Perfect	it has been showing	*
Past Perfect	it had been showing	*
Future Perfect	it will have been showing	*

*No commonly accepted usage in this voice

Emphatic Forms

Tense	Active Voice Only
Present	it does show
Past	it did show

IMPERATIVE MOOD

Used only in the second person, present tense

Active Voice	Passive Voice
[you] show	[you] be shown

SUBJUNCTIVE MOOD

Tense	Active Voice	Passive Voice
Present	[if] it show	[if] it be shown
Past	[if] it showed	[if] it were shown
Future	[if] it will show	[if] it will be shown
Present Perfect	[if] it has shown	[if] it has been shown
Past Perfect	[if] it had shown	[if] it had been shown
Future Perfect	[if] it will have shown	[if] it will have been shown

Each verb form expresses a different shade of meaning. Progressive forms indicate an action in progress at any particular time ("The first film *was showing* when we arrived"). Emphatic forms may add a degree of emphasis, but they are used primarily to form questions ("*Does* it *show*?") and negative statements ("It *does* not *show*"). The imperative mood gives commands ("*Show* what it is like"). The subjunctive mood expresses urgency ("The people insisted that the film *be shown*"); wishing ("I wish it *were being shown* now"); or reflects a condition contrary to fact ("If the film *were shown*, we would be in trouble"). WILLIAM F. IRMSCHER

See also MOOD; NUMBER; PERSON; TENSE; VOICE; VERB.

CONJUGATION is a biological process of reproduction. In the paramecium and certain other protozoa, conjugating organisms exchange *gamete* (reproductive) nuclei only. During the process, two organisms connect by a bridge of *protoplasm* (cellular material). A single nucleus passes through this bridge from each organism to the other. Then, the individuals separate and continue to reproduce by *fission* (splitting). In certain

algae, one whole cell fuses with another of similar size. Still other algae form *conjugation tubes* that connect cells of two filaments or two cells of the same filament. The contents of one cell move through the tube and fuse with the contents of the other. Then, the cell undergoes *meiosis* (reduction division of the nucleus). Only one functional cell results from this division, and it grows into a new filament. NEAL D. BUFFALOE

CONJUNCTION is a word used to connect words, phrases, clauses, and sentences. The term comes from two Latin words that mean *joined with.* There are two kinds of conjunctions, *coordinating* and *subordinating.*

Coordinating Conjunctions connect grammatically equal words, phrases, clauses, or sentences as in the following examples. Words—"He ate bread *and* butter." Phrases—"In red coats *and* with loud drums, the soldiers came marching." Clauses or sentences—"He reads well, *but* his sister reads better."

The principal coordinating conjunctions are:

Expressing addition: and, also, both, as well as, moreover, further, likewise.

Expressing separation or choice: either, or, neither, nor, else, whether, otherwise.

Expressing opposition: but, yet, still, only, nevertheless, whereas.

Expressing effect or result: therefore, hence, consequently, so, so that, thus.

Conjunctions in Pairs, as in the following examples, are called *correlative conjunctions.*

Both . . . and: *Both* John *and* Mary attend school.

Not only . . . but also: He *not only* reads *but also* writes.

Either . . . or: *Either* I must go now *or* I can never go.

Neither . . . nor: *Neither* the child *nor* the man went.

Whether . . . or: *Whether* it rains *or* shines, I will go.

Subordinating Conjunctions join a subordinate clause to the principal clause of a sentence—elements that are not grammatically equal. "He can read better *than* I can." *Than* is a subordinating conjunction connecting the subordinate clause *I can* (*read* is understood) with the principal clause.

The commonest subordinating conjunctions are:

Expressing time and place: when, as, since, while, before, ere, after, until, where.

Expressing cause or reason: because, since, as, whereas, inasmuch as, for.

Expressing condition or supposition: if, unless, though, although, provided, in case, even if.

Expressing purpose or result: that, so that, lest, in order that, so . . . as.

Expressing comparison: than (after comparative), as . . . as, so . . . as. CLARENCE STRATTON

CONJUNCTIVA. See EYE (Parts of the Eye).

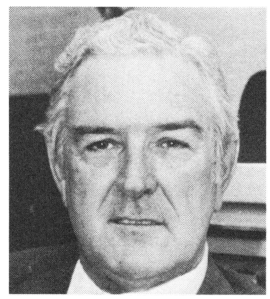
CONJUNCTIVITIS, *kahn JUNK tih VI tihs,* is any inflammation of the membrane covering the outer layer of the eyeball and the inner lining of the eyelids. This membrane is called the *conjunctiva.* In conjunctivitis, the eyes become red and watery and pus may form.

Acute conjunctivitis, also called *pinkeye,* is caused by bacteria and viruses that can be spread to others by using the same towel. Doctors cure bacterial conjunctivitis with antibiotics or sulfonamides. Viruses that can infect the conjunctiva include those that cause colds and measles. Other viruses sometimes infect the conjunctiva and *cornea* (the clear tissue over the colored part of the eye). Victims may lose part or all of their sight. The conjunctiva can also become inflamed by smoke, certain eye drugs, and substances that cause such allergies as hay fever. WILLIAM F. HUGHES

See also ALLERGY; TRACHOMA.

CONNALLY, JOHN BOWDEN (1917-), was United States secretary of the treasury in 1971 and 1972. He was the first Democrat appointed to the Cabinet by President Richard M. Nixon, a Republican. Connally served as governor of Texas from 1963 to 1969. In 1973, he changed his party affiliation to Republican.

As secretary of the treasury, Connally helped bring about a realignment of international currency exchange rates, including devaluation of the U.S. dollar. He also served as chairman of the Cost of Living Council to oversee federal controls on wages and prices.



Wide World

John Connally

In July, 1974, a federal grand jury indicted Connally for accepting a bribe, conspiracy to obstruct justice, and perjury. The jury charged that while Connally was secretary of the treasury, he took $10,000 from milk producers in return for recommending an increase in federal price supports for milk. Connally was tried on the bribery charges in April, 1975, and found not guilty. The other charges were dropped.

Connally was born in Floresville, Tex., and graduated from the University of Texas School of Law. After serving as a Navy lieutenant commander during World War II, he became the manager of a radio station in Austin, Tex., in 1946. During the 1950's, Connally was attorney for a Texas oil company.

In 1961, President John F. Kennedy named Connally secretary of the Navy. Connally resigned after 11 months to seek the Texas governorship. In November, 1963, he was seriously wounded while riding in Kennedy's car in Dallas when the President was assassinated. From the beginning of his political career, Connally had close ties with former President Lyndon B. Johnson, another Texan. WILLIAM J. EATON

CONNAUGHT, DUKE OF (1850-1942), ARTHUR WILLIAM PATRICK ALBERT, the third son of Queen Victoria, served as governor general of Canada from 1911 to 1916. Before going to Canada, he opened the first parliament of the Union of South Africa on behalf of the king. Connaught served in Canada during the Fenian Raid in 1870. He also served in Egypt, India, and Ireland. He was promoted to the rank of general in 1893 and to field marshal in 1902. From 1907 to 1909, he commanded British forces in the Mediterranean. Connaught was born in London. LUCIEN BRAULT

CONNAUGHT TUNNEL is the longest double-track railway tunnel in North America. It carries the Canadian Pacific Railway 5 miles (8 kilometers) through Mount Macdonald in the Selkirk range of southeastern British Columbia. Work began on the tunnel in 1913. It was completed in 1916. RODERICK HAIG-BROWN

Eric M. Sanford

Historic Village Green and Church in Litchfield

CONNECTICUT, *kuh NEHT ih kuht*, is the third smallest state. Only Delaware and Rhode Island have smaller areas. In spite of its small size, Connecticut is an important industrial state and a favorite vacationland. Hartford, the capital and largest city of Connecticut, is known as the *Insurance Capital of the World*. About 40 insurance companies have headquarters in Hartford.

Connecticut is one of the nation's leading producers of helicopters, jet aircraft engines, propellers, and submarines. It also ranks high among the states in the processing of copper, and in the production of ball and roller bearings, clocks and watches, cutlery, electric conductors, optical instruments, and silverware.

The mighty Connecticut River cuts through the center of the state. The river flows into Long Island Sound, Connecticut's outlet to the Atlantic Ocean. The word *Connecticut* comes from an Algonkian Indian word meaning *on the long tidal river*. Most of the state's big industrial cities are west of the Connecticut River. They stretch from Hartford in central Connecticut to Stamford near the southwestern border of the state. New York City lies south of Connecticut. Thousands of Connecticut men and women commute to work in the giant metropolis.

Connecticut's rural areas and small towns contrast sharply with its industrial cities. Many towns center around a *green* (public park). Near the green may stand a small white church, a town meeting hall, a tavern, and several colonial houses. Forests, rivers, lakes, waterfalls, and a sandy shore add to Connecticut's beauty.

The people of Connecticut played important parts in the history and industrial development of the United States. Connecticut delegates to the Constitutional Convention of 1787 worked out the *Connecticut Compromise*. The compromise broke a deadlock over how many men each state should elect to the U.S. Congress. The compromise also earned Connecticut the nickname of the *Constitution State*. Connecticut provided large quan-

CONNECTICUT

THE CONSTITUTION STATE

The contributors of this article are Bob Eddy, Editor of The Hartford Courant; *Joseph B. Hoyt, Chairman of the Social Science Department at Southern Connecticut State College, and author of* The Connecticut Story; *and Albert E. Van Dusen, State Historian of Connecticut, Professor of History at the University of Connecticut, and author of* Connecticut.

FACTS IN BRIEF

Capital: Hartford.

Government: *Congress*—U.S. senators, 2; U.S. representatives, 6. *Electoral Votes*—8. *State Legislature*—senators, 36; representatives, 151. *Counties*—8 (Connecticut has no county governments). *Towns*—169.

Area: 5,009 sq. mi. (12,973 km²), including 147 sq. mi. (381 km²) of inland water and excluding 573 sq. mi. (1,484 km²) of Long Island Sound; 48th in size among the states. *Greatest Distances*—east-west, 90 mi. (145 km); north-south, 75 mi. (121 km). *Coastline*—618 mi. (995 km).

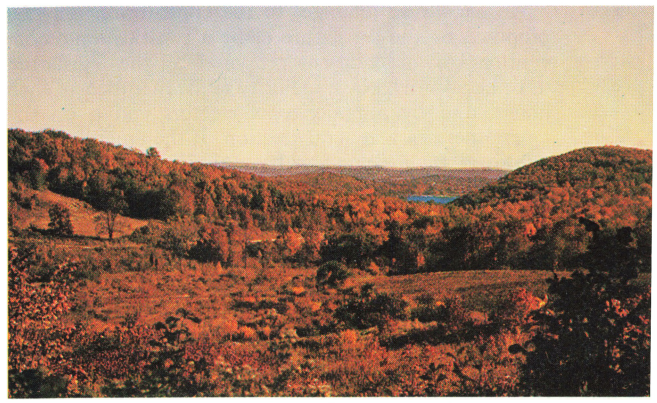
Elevation: *Highest*—2,380 ft. (725 m) above sea level, on the south slope of Mount Frissell. *Lowest*—sea level along the Long Island Sound shore.

Population: *Estimated 1975 Population*—3,288,000; 24th among the states; distribution, 77 per cent urban, 23 per cent rural; density, 656 persons per sq. mi. (253 persons per km²). *1970 Census*—3,032,217.

Chief Products: *Agriculture*—apples, beef cattle, broilers, eggs, greenhouse and nursery products, milk, tobacco. *Fishing Industry*—clams, flounder, lobsters, oysters, shad. *Manufacturing and Processing*—chemicals, food and related products, instruments, machinery, metal products, primary metals, printing and publishing, rubber and plastics products, textiles, transportation equipment. *Mining*—clays, sand and gravel, stone.

Statehood: January 9, 1788, the fifth state.

State Motto: *Qui transtulit sustinet* (He who transplanted still sustains).



Connecticut Development Commission

Autumn Scene near Goshen

Connecticut Development Commission

Constitution Plaza in Hartford

tities of food, clothing, and other supplies to the Colonial Army during the Revolutionary War. For this reason, George Washington honored Connecticut with another nickname—the *Provisions State*.

Eli Whitney made Connecticut the birthplace of mass-production manufacturing. Working in Hamden, he showed the advantages of using interchangeable parts in gunmaking. Whitney's methods led to the high-speed industrial production methods of today. Steel manufacturing began in Hartford County. Connecticut men were also the first Americans to make bicycles, dyed silk, friction matches, printing type, repeating pistols, rubber shoes, and vulcanized rubber. The first insurance policies covering accidents, automobiles, and aircraft were written in Hartford. The *Nautilus*, launched in Groton in 1954, was the world's first nuclear-powered submarine.

For the relationship of Connecticut to other states in its region, see NEW ENGLAND.

Connecticut (blue) ranks 48th in size among all the states, and 5th in size among the New England States (gray).

Constitution of Connecticut was adopted in 1965. It replaced an earlier constitution adopted in 1818. Colonial Connecticut's first constitution was the Fundamental Orders of 1639. Connecticut governed itself under the Fundamental Orders until it received a royal charter in 1662. The charter was the constitution until 1818.

An *amendment* (change) to the constitution may be proposed by the legislature or by a constitutional convention. An amendment proposed by the legislature must be approved by a majority of the members of each house, and by a majority of electors voting on the amendment in a general election. If the amendment is approved by a three-fourths majority of each house, electors vote on it in the next general election. If it is approved by a majority of less than three-fourths of each house, it must be approved again by a majority in the next regular session of the legislature. Then it is voted on in a general election.

A constitutional convention may be called by a two-thirds vote in each house of the legislature, or by a majority of electors voting on the question. An amendment proposed by a convention must be approved by a majority of the electors.

Executive. The governor of Connecticut is elected to a four-year term. He receives a $42,000 annual salary. The governor may be re-elected any number of times. For a list of all the governors of Connecticut, see the *History* section of this article.

The voters also elect the lieutenant governor, attorney general, comptroller, secretary of the state, and state treasurer to four-year terms. The governor, with the approval of either house of the legislature, appoints most other top executive officials. These officials include the commissioners of agriculture, banking, finance, health, highways, insurance, labor, taxes, and welfare.

Legislature, called the *general assembly*, consists of a 36-member senate and a 151-member house of representatives. Voters in each of Connecticut's 36 senatorial districts elect one senator. Voters in each of the state's 151 assembly districts elect one representative. Senators and representatives serve two-year terms.

The legislature meets every year. Regular sessions begin on the Wednesday after the first Monday in January in odd-numbered years and on the Wednesday after the first Monday of February in even-numbered years. The sessions must end by the Wednesday after the first Monday in June in odd-numbered years and by the Wednesday after the first Monday in May in even-numbered years. Special sessions, which may be called by the governor, have no time limits.

In 1965 and 1971, Connecticut *reapportioned* (redivided) its legislature to provide equal representation based on population. For a discussion of reapportionment, see *The Mid-1900's* section of this article.

Courts. The supreme court is Connecticut's highest court. It is a court of appeals, and has a chief justice and five associate justices. The superior court is the state's highest trial court. It has 40 judges. Supreme Court justices and superior court judges are nominated by the governor and appointed by the legislature. They serve eight-year terms.

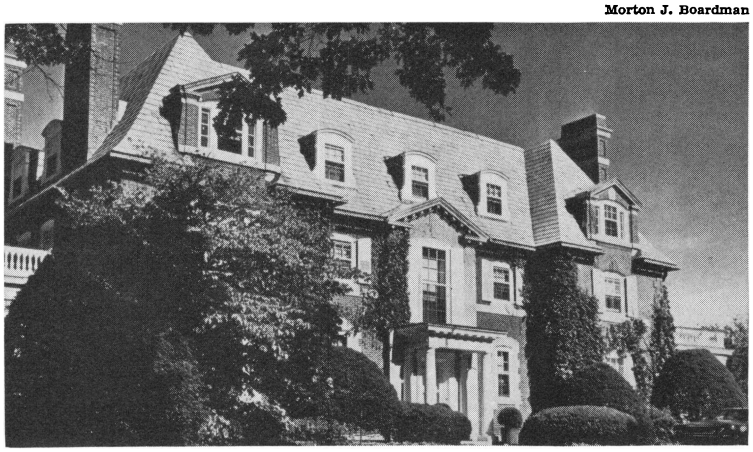
Connecticut also has a court of common pleas, a circuit court, and a juvenile court. The judges of these courts are nominated by the governor and appointed by the legislature. All of these judges serve four-year terms. The people elect judges for the state's 129 probate courts. These judges also serve four-year terms.

Local Government in Connecticut is centered in 169 *towns*. Connecticut towns are similar to *townships* in other states. The towns may include several communities and large rural areas under one government.

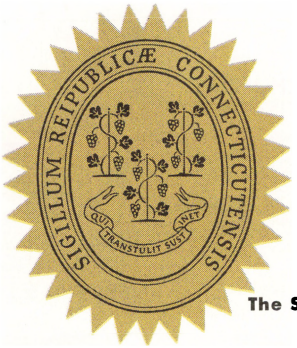
Most small Connecticut towns use the town meeting form of government. This pure form of democracy allows citizens to take a direct part in government. Each year, town voters meet to elect officials, approve budgets, and decide other business. See TOWN MEETING.

Some towns have heavily populated areas called *boroughs* and *cities*. Most of Connecticut's 11 boroughs have a government that is independent of the town government. In most of the state's 23 cities, the city and town governments operate as one unit—called a *city government*. The most common form of city government is the mayor-council type. Some cities use the council-manager form. Connecticut cities operate under state charters. All chartered cities have *home rule*—they are free to amend their own charters. Connecticut and

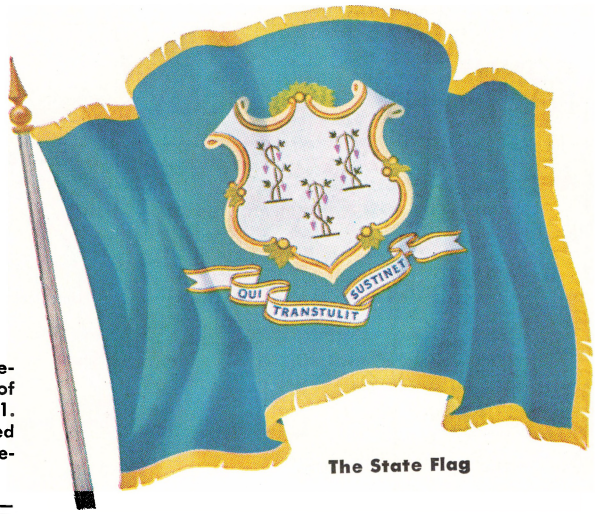
Morton J. Boardman



The Governor's Mansion, surrounded by 6 acres (2.4 hectares) of grounds, overlooks Hartford. The house was built for private use, but was bought by the state in 1943. Many of the mansion's furnishings date from the 1700's.



The **State Seal**



The State Flag

Symbols of Connecticut. On the state seal, the three grapevines symbolize the transplanting of the culture and traditions of Europe to the colony of Connecticut. The seal was adopted in 1931. The grapevines also appear on the state flag, which was adopted in 1897. Earlier flags, dating back to the 1770's, used the grapevine symbol, but were not official state flags.

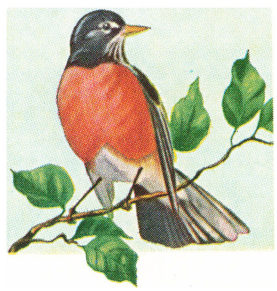
Flag, bird, and flower illustrations, courtesy of Eli Lilly and Company

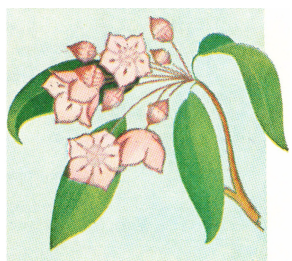
Rhode Island are the only states that do not have county governments. Counties in these states are divisions of court systems.

Taxation provides about four-fifths of the Connecticut government's income. Almost all the rest comes from federal grants and other U.S. government programs. Sales and gross receipts taxes bring in the largest percentage of the state's income. These taxes include, in order of importance, a general sales and gross receipts tax, a corporation income tax, and taxes on other businesses, inheritances and estates, cigarettes, and alcoholic beverages. The state also earns income from license and permit fees.

Politics. Connecticut gave early support to the Republican Party after the party was formed in 1854. In presidential elections between 1856 and 1932, Connecticut voted for 15 Republicans and only 5 Democrats. The voters chose about three times as many Republicans as Democrats for governor during the same period. The Democrats gained strength during the 1930's. Since 1960, registered Democratic voters have outnumbered registered Republicans in Connecticut. For Connecticut's electoral votes and voting record in presidential elections, see ELECTORAL COLLEGE (table).

The State Bird
Robin

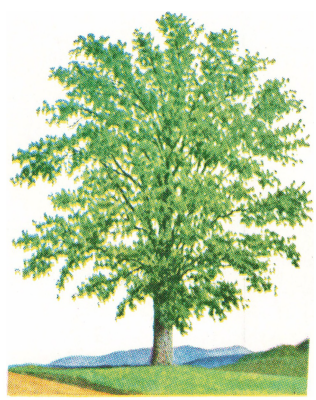




The State Flower
Mountain Laurel

State Capitol in Hartford was completed in 1879. It is built of granite and marble. New Haven and Hartford were twin capitals from 1701 to 1875, when Hartford became the only capital.
Connecticut Development Commission

The State Tree
White Oak



CONNECTICUT
Political Map
State capital
Urban area in Connecticut
Urban area outside Connecticut
City or town
County courthouse
TOLLAND County name
County boundary
State boundary
Military or other federal area
Point of interest
Major airport
Water
River
Intermittent lake
Highways:
Expressway
Other road
Interstate
U. S.
Other
Polyconic projection
WORLD BOOK map
©Field Enterprises Educational Corporation
MASSACHUSETTS
NEW YORK
NEW JERSEY
Long Island
Hartford
New Haven
Waterbury
Bridgeport
Stamford
Norwalk
Danbury
New Britain
Meriden
Torrington
New Milford
Milford
Greenwich
New York City
Distance Scale
0 5 10 15 20 25 30 35 40 45 50
0 5 10 15 20 25 30 35 45 50 60 70 80

9
10
11
12
13
14
15
16
A
B
C
D
E
F
G
H
I
J
K
Westfield
Springfield
MASSACHUSETTS
East Longmeadow
Southbridge
Webster
Thompsonville
Suffield
Hazardville
Somers
Enfield
Stafford Springs
Windsor Locks
Warehouse Point
Broad Brook
Ellington
TOLLAND
Rockville
Windsor
Bloomfield
Wilson
East Hartford
Manchester
Hartford
Coventry
South Coventry
Glastonbury
Wethersfield
Newington
Rocky Hill
South Glastonbury
Berlin
Cromwell
Portland
Middletown
Middlefield
Durham
Middlefield
Moodus
Salem
Montville
Uncasville
Chester
Deep River
Essex
East Lyme
New London
Groton
Old Saybrook
Guilford
Madison
Clinton
Willimantic
Scotland
Windham
Plainfield
Hampton
Putnam
Danielson
East Brooklyn
Norwich
Colchester
Lebanon
Baltic
Lisbon
Jewett City
Voluntown
Preston City
Ledyard
Quaker Hill
Pawcatuck
Westerly
Stonington
Mystic
Groton
Niantic
Waterford
Morningside Park
Pleasure Beach
Fishers Island
Block Island Sound
North Atlantic Ocean
Long Island
Sag Harbor
Greenport
Riverhead
Shelter Island
Montauk Point
Block Island
Sandy Point
Plum Island
Gardiners Island
Gardiners Bay
Sound
North
RHODE ISLAND
42° North Latitude
41° 30′ North Latitude
41° North Latitude
72° 30′ West Longitude
72° West Longitude
60
70
80
90
100
Miles
90
100
110
120
130
140
150
160
Kilometres

CONNECTICUT MAP INDEX

Population

3,288,000 Estimate..1975
3,032,217 ..Census..1970
2,535,234 .....“.....1960
2,007,280 .....“.....1950
1,709,242 .....“.....1940
1,606,903 .....“.....1930
1,380,631 .....“.....1920
1,114,756 .....“.....1910
908,420 .....“.....1900
746,258 .....“.....1890
622,700 .....“.....1880
537,454 .....“.....1870
460,147 .....“.....1860
370,792 .....“.....1850
309,978 .....“.....1840
297,675 .....“.....1830
275,248 .....“.....1820
261,942 .....“.....1810
251,002 .....“.....1800
237,946 .....“.....1790

Metropolitan Areas

Bridgeport 401,752
Bristol 69,878
Danbury 115,538
Hartford 720,581
Meriden 55,959
New Britain 145,269
New Haven-
West Haven ...413,722
New London-
Norwich 241,862
(219,222 in Conn.;
22,640 in R.I.)
Norwalk 127,535
Springfield-
Chicopee-
Holyoke (Mass.) 541,752
(534,859 in Mass.;
6,893 in Conn.)
Stamford 206,340
Waterbury 216,808

Counties

Fairfield ..792,814..H 5
Hartford ..816,737..C 9
Litchfield ..144,091..C 5
Middlesex ..115,081..G 10
New Haven 744,948..G 7
New
London .230,654..F 13
Tolland ...103,440..C 11
Windham ..84,515..C 13

Cities, Towns, and Boroughs

Abington .....C 13
Allington .....H 7
Almyville .....D 14
Amesville .....B 4
Amston .....E 11
Andover ....2,099▲..D 11
Ansonia ...21,160..G 6
Ashford ....2,156▲..C 13
Aspetuck .....I 5
Attawaugan .....C 14
Atwoodville .....D 12
Avon .....8,352▲..C 8
Bakersville .....C 7
Ballouville .....C 14
Baltic .....E 13
Bantam .....881..D 5
Barkham-
sted .....2,066▲..B 7
Bashan .....F 11
Beacon Falls 3,546▲..G 7
Berlin .....14,149▲..E 9
Bethany ....3,857▲..G 7
Bethel .....10,945▲..G 4
Bethlehem ...1,923▲..E 6
Black Point .....H 12
Bloomfield .18,301▲..C 9
Boardman Bridge ..E 4
Bolton .....3,691▲..D 11
Botsford .....G 5
Bozrah .....2,036▲..F 12
Bozrah Street .....F 12
Bradleyville .....F 6
Branchville .....H 4
Branford ...2,080
(20,444▲)..H 8
Bridgeport 156,542.●1 6
Bridgewater ..1,277▲..F 5
Bristol ....55,487..D 7
Broad Brook 1,548..B 10
Brookfield ..9,688▲..F 4
Brookfield Center ..F 4
Brooklyn ....4,965▲..C 14
Brooksvale .....F 7
Bulls Bridge .....D 4
Burlington ..4,070▲..D 7
Burnetts Corner ....G 14
Burnside .....D 9
Campville .....D 6
Canaan* .....931▲..A 5
Canaan .....1,083..A 5
Canaan Valley .....A 5
Candlewood Knolls ..F 4
Cannondale .....I 4
Canterbury ..2,673▲..D 14
Canton .....6,868▲..C 8
Canton Center .....C 7
Center Groton .....G 13
Centerbrook .....G 11
Central Village .....D 14
Chaplin .....1,621▲..C 13
Cheshire ...19,051▲..F 8
Chester 1,569
(2,982▲)..G 11
Chesterfield .....G 12
Chestnut Hill .....D 12
Clarks Corner .....D 13
Clarks Falls .....F 15
Clinton 5,957
(10,267▲)..H 10
Cobalt .....E 10
Colchester ...3,529
(6,603▲)..E 12
Colebrook ...1,020▲..B 6
Collinsville .2,897..C 7
Columbia ...3,129▲..D 12
Conning Towers-
Nautilus
Park* ....9,791..G 13
Cornwall ...1,177▲..C 5
Cornwall Bridge ...C 4
Cornwall Center ...C 5
Cornwall Hollow ...C 5
Coventry ....8,140▲..C 11
Cromwell ...7,400▲..E 9
Crystal Lake .....B 11
Danbury ...50,781..●G 4
Danielson ...4,580..C 14
Darien .....20,411▲..J 4
Dayville .....C 14
Deep River ..2,333
(3,690▲)..G 11
Derby .....12,599..H 6
Doaneville .....E 14
Dodgingtown .....G 5
Drakeville .....C 6
Durham ....4,489▲..F 9
Durham Center ....F 9
Eagleville .....C 12
East Berlin .....E 9
East Brook-
lyn .....1,377..C 14
East Canaan .....A 5
East Glastonbury ...D 10
East Granby 3,532▲..B 9
East Had-
dam .....4,676▲..F 11
East Hamp-
ton 1,982
(7,078▲)..E 10
East Hart-
ford ....57,583▲..D 9
East Hartland .....B 8
East Haven 25,120▲..H 8
East Killingly .....C 15
East Litchfield ....D 6
East Lyme .11,399▲..G 12
East Morris .....D 6
East Plymouth .....D 7
East Putnam .....B 15
East River .....H 9
East Thompson ....A 15
East Village .....G 6
East Willington ....C 12
East
Windsor* ..8,513▲..D 9
East Windsor Hill ..C 10
East Woodstock ...B 14
Eastford .....922▲..B 13
Easton .....4,885▲..H 5
Ekonk .....E 14
Ellington ....7,707▲..D 10
Ellsworth .....C 4
Elmville .....C 14
Enfield ....46,189▲..B 10
Essex 2,473
(4,911▲)..G 11
Fabyan .....A 14
Fairfield ...56,487▲..I 5
Falls Village .....B 5
Farmington 14,390▲..D 8
Fenwick .....45..H 11
Fitchville .....E 13
Flanders .....D 4
Franklin ...1,356▲..E 13
Gales Ferry .....G 13
Gaylordsville .....E 4
Georgetown ..1,101..H 4
Germantown .....G 4
Gilead .....D 11
Gilman .....E 12
Glasgo .....F 14
Glastonbury 20,651▲..D 10
Glenville .....J 3
Goshen .....1,351▲..C 5
Goshen Hill .....E 12
Granby .....6,150▲..B 8
Greens Farms .....I 5
Greenwich ..59,755▲..J 3
Greystone .....E 7
Griswold* ...7,763▲..E 14
Grosvenor Dale ...B 14
Groton 8,933
(38,244▲)..G 13
Grove Beach .....H 10
Guilford 3,632
(12,033▲)..H 9
Gurleyville .....C 12
Haddam ....4,934▲..F 10
Hadlyme .....G 11
Hallville .....F 13
Hamburg .....G 11
Hamden ...49,357▲..G 8
Hampton ....1,129▲..D 13
Hancock .....E 7
Hanover .....E 13
Harrisville .....B 14
Hartford ..158,017..●D 9
Hartland ....1,303▲..B 7
Harwinton ..4,318▲..D 7
Hattertown .....G 5
Hawleyville .....G 5
Hayden .....C 9
Hazardville .....B 10
Hebron .....3,815▲..E 11
Higganum .....F 10
Hopeville .....G 14
Hoskins .....B 8
Hotchkissville .....E 5
Huntingtown .....G 5
Huntsville .....B 5
Hydeville .....B 12
Indian Neck .....H 8
Ivoryton .....G 11
Jewett City ..3,372..E 14
Judds Bridge .....E 5
Kensington .....E 8
Kent .....1,990▲..D 4
Kent Furnace .....D 4
Killingly* ...13,573▲..C 14
Killingly Center ...C 14
Killingworth 2,435▲..G 10
Lake Poco-
topaug* ....1,515..E 10
Lakeside .....D 5
Lakeville .....B 4
Laurel Glen .....F 15
Laysville .....G 12
Lebanon ....3,804▲..E 12
Ledyard ...14,837▲..G 13
Leesville .....F 10
Leetes Island .....H 9
Leffingwell .....F 13
Liberty Hill .....E 12
Lime Rock .....B 4
Lisbon .....2,808▲..E 13
Litchfield ...1,559
(7,399▲)..●D 6
Long Ridge .....I 3
Long Society .....F 13
Lords Point .....G 14
Lyme* .....1,484▲..G 11
Lyons Plain .....I 5
Macedonia .....D 4
Madison 4,310
(9,768▲)..H 10
Manchester .47,994▲..D 10
Mansfield ..19,994▲..C 12
Mansfield Center ...D 12
Mansfield Depot ...C 11
Marble Dale .....E 4
Marion .....E 7
Marlborough 2,991▲..E 11
Mashapaug .....A 13
Mechanicsville .....B 14
Melrose .....B 10
Meriden ....55,959..F 8
Merrow .....C 11
Middle Haddam ...F 10
Middlebury 5,542▲..F 6
Middlefield .4,132▲..E 9
Middletown 36,924.●F 9
Milford ....50,858..I 7
Mill Plain .....I 5
Milldale .....E 8
Millington .....F 11
Millstone .....H 13
Milton .....D 5
Minortown .....E 6
Mixville .....F 7
Mohegan .....F 13
Monroe ....12,047▲..H 6
Montville 1,688
(15,662▲)..F 13
Moodus .....1,352..F 11
Moosup .....3,376..D 14
Morningside
Park .....3,458..G 13
Morris .....1,609▲..D 6
Mount Hope .....C 12
Mystic .....2,568..G 14
Naugatuck .23,034..F 7
Nautilus Park,
see Conning Towers-
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*Does not appear on the map; key shows general location.
▲Entire town (township), including rural area.
●County courthouse.

Sources: Latest census figures (1970). Places without population figures are unincorporated areas and are not listed in census reports.

CONNECTICUT / *People*

The 1970 United States census reported that Connecticut had 3,032,217 persons. The population had increased 20 per cent over the 1960 figure, 2,535,234. This was one of the largest percentages of increase among the states that make up the northeastern United States. The U.S. Bureau of the Census estimated that by 1975 the state's population had reached about 3,288,000.

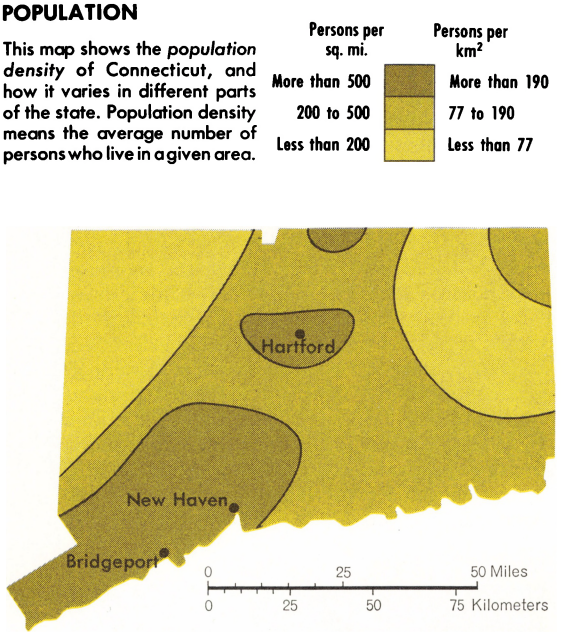
About $2\frac{3}{4}$ million people, or about 89 per cent of the population, live in 12 Standard Metropolitan Statistical Areas (see METROPOLITAN AREA). These are Bridgeport, Bristol, Danbury, Hartford, Meriden, New Britain, New Haven-West Haven, New London-Norwich, Norwalk, Springfield-Chicopee-Holyoke (Mass.), Stamford, and Waterbury. For their populations, see the *Index* of the political map of Connecticut.

Hartford is Connecticut's capital and largest city. Other large cities, in order of population, include Bridgeport, New Haven, Stamford, and Waterbury. See the separate articles on Connecticut cities listed in the *Related Articles* at the end of this article.

Most of Connecticut's people were born in the United States. Italians make up the largest of the groups born in other countries. Roman Catholics form the state's largest single religious group. Other large religious groups include Baptists, Episcopalians, Methodists, and members of the United Church of Christ.

POPULATION

This map shows the *population density* of Connecticut, and how it varies in different parts of the state. Population density means the average number of persons who live in a given area.



WORLD BOOK map

CONNECTICUT / *Education*

Schools. Connecticut's Yale University, founded in 1701, is the third oldest U.S. university. Only Harvard University and the College of William and Mary are older. The Litchfield School was one of the first law schools in the United States. It operated in Litchfield between 1784 and 1833. In 1817, Thomas H. Gallaudet founded the first free American school for the deaf, in Hartford. The school now operates in West Hartford as the American School for the Deaf.

John Higginson, a teacher and minister, founded Connecticut's first school about 1637. A law passed in 1650 required Connecticut towns with more than 50 families to have an elementary school. The law also required towns with more than a hundred families to have a *secondary* (high) school.

A commissioner of education and a 10-member board of education supervise Connecticut's public-school system. The governor appoints the board members to six-year terms, and the board members elect the commissioner to the same term.

Connecticut law requires children between the ages of 7 and 16 to attend school. For the number of students and teachers in Connecticut, see EDUCATION (table).

Libraries. The Yale University Library, founded in 1701, is the oldest library still operating in Connecticut. Its 6 million volumes make it one of the world's largest libraries. The Scoville Memorial Library in Salisbury was founded in 1803 as the Bingham Library for Youth. In 1810, Salisbury began using taxes to support the library. Some historians believe it was the first free, tax-supported public library in the United States.

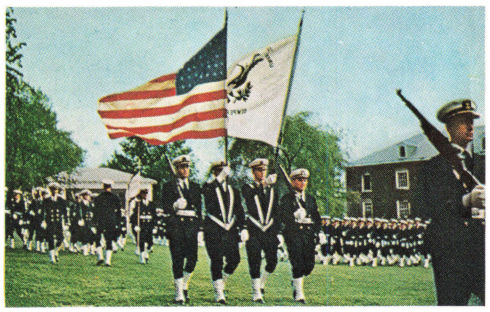
UNIVERSITIES AND COLLEGES

Connecticut has 22 universities and colleges accredited by the New England Association of Colleges and Secondary Schools. For enrollments and further information, see UNIVERSITIES AND COLLEGES (table).

Name	Location	Founded
Albertus Magnus College	New Haven	1925
Annhurst College	Woodstock	1941
Bridgeport, University of	Bridgeport	1927
Central Connecticut State College	New Britain	1849
Connecticut, University of	Storrs	1881
Connecticut College	New London	1911
Eastern Connecticut State College	Willimantic	1889
Fairfield University	Fairfield	1942
Hartford, University of	West Hartford	1957
Hartford Seminary Foundation	Hartford	1836
New Haven, University of	West Haven	1958
Quinnipiac College	Hamden	1929
Rensselaer Polytechnic Institute of Connecticut	Hartford	1955
Sacred Heart University	Bridgeport	1967
St. Alphonsus College	Suffield	1963
St. Joseph College	West Hartford	1925
Southern Connecticut State College	New Haven	1893
Trinity College	Hartford	1823
United States Coast Guard Academy	New London	1876
Wesleyan University	Middletown	1831
Western Connecticut State College	Danbury	1904
Yale University	New Haven	1701

Today, Connecticut has over 200 public libraries and many school and special libraries. The largest public libraries are in Bridgeport, Hartford, and New Haven. The State Library in Hartford houses the state archives, many books about Connecticut, and a special law collection. Hartford has special law and insurance libraries.

Museums. Yale's Peabody Museum has world-famous natural history exhibits. The Yale University Art Gallery is the oldest university art museum in the United States. Other fine art museums are in Farmington, Hartford, Middletown, New Britain, New London, and Norwich. Children's museums are in Canton, New London, Stamford, and West Hartford. The American Clock and Watch Museum in Bristol displays timepieces made in the 1700's and 1800's. The New Haven Colony Historical Society exhibits the original model of Eli Whitney's cotton gin. The society also owns valuable prints and early American portraits.



U.S. Coast Guard

Parading the Colors, cadets at the U.S. Coast Guard Academy in New London march on the parade grounds.

Yale University, in New Haven, is the third oldest U.S. university. Harkness Tower rises above the campus.

C. T. Albertus

CONNECTICUT / *A Visitor's Guide*

Southern Connecticut's seashore offers vacationers swimming, fishing, boating, and beautiful scenery. Inland, many summertime visitors hike and ride horseback across the state's wooded hills and valleys. Hunters follow winding forest trails in search of rabbits, raccoons, squirrels, and other small game. Fishermen try their luck in Connecticut's rivers, streams, and lakes. In winter, the state's snow-covered hills provide skiing and other winter sports. Tourists and students of American history also may visit many historic sites, museums, and colonial buildings.

A Summer Day at Rocky Neck State Park

Connecticut Development Commission

Old Town Mill in New London

PLACES TO VISIT

Following are brief descriptions of some of Connecticut's many interesting places to visit.

Cathedral Pines, in Cornwall, is often called one of America's most beautiful forests. This white pine woodland is so thick in some places that sunlight seldom reaches the ground below the trees.

Colonial Buildings are among Connecticut's most famous landmarks. Almost every Connecticut town has at least one example of Colonial architecture. *Whitfield House*, in Guilford, is the oldest house in the state. It was begun in 1639, and may also be the oldest stone house in New England. Three buildings stand as shrines to Nathan Hale, the famous Connecticut patriot. *Nathan Hale Homestead* in South Coventry was the home of Hale's parents. In East Haddam and New London

Mystic Seaport in Mystic

ANNUAL EVENTS

The best-known annual event in Connecticut is probably the American Shakespeare Festival in Stratford. Plays by William Shakespeare, England's greatest dramatist, are performed in a building patterned after the *Globe*, a London theater of Shakespeare's time. The Shakespeare Festival lasts from mid-June to early September. Country fairs are held in various Connecticut towns from early August to mid-October.

Other annual events in Connecticut include the following.

March-May: Spring Flower and Garden Show in Hartford (March, no fixed date); Children's Services Horse Show in Farmington (mid-May).

June-July: Barnum Festival in Bridgeport (first week in July); Litchfield Open House (second week in July); Deep River Ancient Muster of Fife and Drum Corps (mid-July).

August-October: Mystic Outdoor Art Festival (second week in August); American Dance Festival in New London (throughout August); Greater Hartford Open Golf Tournament in Wethersfield (September); Connecticut Antique Show in New Haven (late September); Danbury State Fair (first week in October).

Trolley Museum in East Haven

Whitfield House in Guilford

Connecticut Development Commission

Shakespeare Festival Theatre in Stratford

are the *Nathan Hale Schoolhouses*, where Hale taught school from 1773 to 1775. Other Connecticut colonial buildings, with the location and original completion date of each, include *Stanley-Whitman House* (Farmington, 1660); *Pardee-Morris House* (New Haven, 1685); *Mansfield House* (Ansonia, before 1690); *Buttolph-Williams House* (Wethersfield, 1692); *Denison House* (Mystic, 1717); *Judson House* (Stratford, 1723); *Nathaniel Allis House* (Madison, 1739); *Glebe House* (Woodbury, 1750?); and *Webb House* (Wethersfield, 1752).

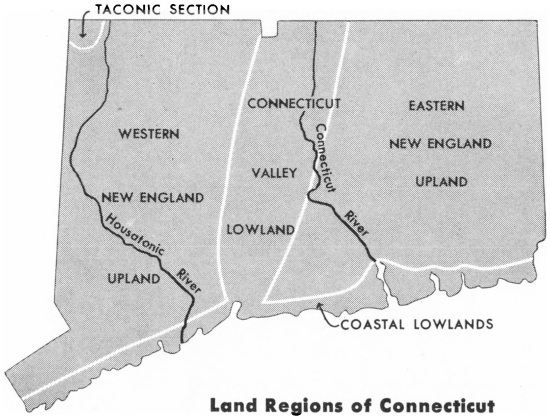
Groton Monument, in Groton, is a granite tower 134 feet (41 meters) high. It commemorates the Battle of Fort Griswold in 1781. British troops, led by the traitor Benedict Arnold, massacred patriots they captured in the battle.

Mystic Seaport and Marine Museum, in Mystic, recall Connecticut's seafaring tradition. The seaport has been rebuilt to look like a whaling village of the 1800's. The *Charles W. Morgan*, New England's last wooden whaling ship, is in the harbor. The *Joseph Conrad*, a square-rigged training vessel built in Copenhagen in 1882, is also there.

Old Town Mill, in New London, is an old grain-grinding mill set in scenic surroundings. The mill was built in 1650 and rebuilt in 1712.

Trolley Museums exhibit trolleys that date from the late 1800's and early 1900's. Visitors may ride on some of the trolleys. The museums are the Branford Trolley Museum in East Haven, and the Connecticut Electric Railway Association Museum in Warehouse Point.

State Parks and Forests. Connecticut has 85 state parks and 29 state forests. For information, write to State Department of Environmental Protection, State Office Building, Hartford, Conn. 06115.



Land Regions of Connecticut

Land Regions. Connecticut has five main land regions: (1) the Taconic Section, (2) the Western New England Upland, (3) the Connecticut Valley Lowland, (4) the Eastern New England Upland, and (5) the Coastal Lowlands.

The Taconic Section covers the northwestern corner of Connecticut between the Housatonic River and the New York border. This region also extends north into Massachusetts. It includes the highest point in Connecticut, on the south slope of Mount Frissell.

The Western New England Upland occupies most of western Connecticut, and parts of Massachusetts and Vermont. In Connecticut, it lies from 1,000 to 1,400 feet (300 to 427 meters) above sea level. The land slopes from northwest to southeast. Many rivers flow between the region's ridges and steep hills.

The Connecticut Valley Lowland extends through the center of Connecticut and north into Massachusetts. It averages 20 miles (32 kilometers) in width. Lava ridges, including Hanging Hills, Mount Lamentation, and Talcott Mountain, rise from 300 to 600 feet (91 to 180 meters) above the rivers of the region.

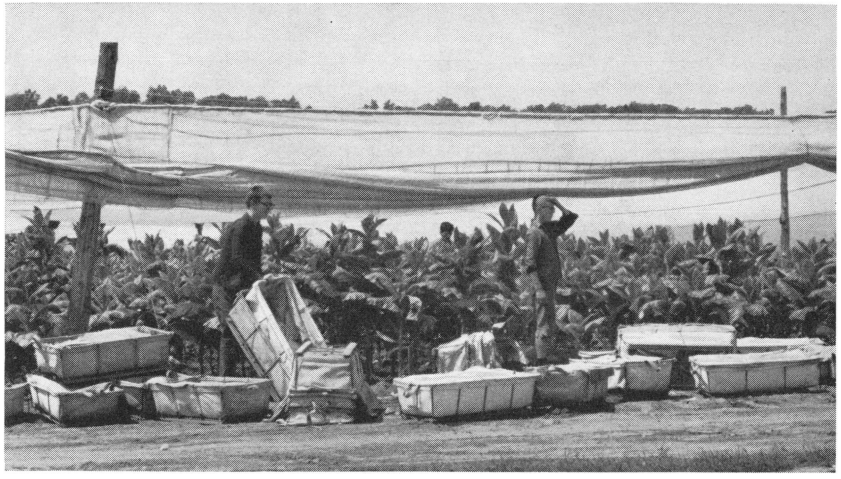
The Eastern New England Upland covers most of eastern Connecticut. The entire upland stretches from Connecticut to Maine. In Connecticut, it is heavily forested, and has narrow river valleys and low hills. Few of the hills rise as high as 1,200 feet (366 meters). The land slopes gradually from northwest to southeast.

The Coastal Lowlands are part of a larger region of the same name that covers the New England coast. In Connecticut, the region is a narrow belt, from 6 to 16 miles (10 to 26 kilometers) wide, along the southern shore. The lowlands are somewhat lower and smoother than the rest of the state. They are broken by low ridges, and beaches and harbors along the coast.

Coastline. Connecticut's 618-mile (995-kilometer) shoreline includes bays and the mouths of many rivers. The Connecticut shore has many fine harbors, including Greenwich, Stamford, Norwalk, Bridgeport, New Haven, and New London. Long Island, a part of New

Tobacco Grown in the Shade is Connecticut's most valuable farm crop. This special tobacco is raised in the Connecticut Valley Lowland region, and is used as the outer wrapping of cigars.

Connecticut Development Commission



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CONNECTICUT

York south of Connecticut, helps protect Connecticut's shore from Atlantic storms.

Several small islands lie off the Connecticut coast. The largest, Mason's Island, covers about $1\frac{1}{2}$ square miles (3.9 square kilometers) near Mystic. Other islands include the Norwalk Islands off Norwalk, and The Thimbles near Branford.

Mountains. Connecticut's highest mountains are all in northwestern Litchfield County. The highest point in the state, on the south slope of Mount Frissell, has an altitude of 2,380 feet (725 meters). The top of Mount Frissell is in Massachusetts. Other mountains include Bear Mountain (2,355 feet, or 718 meters), Mount Gridley (2,200 feet, or 671 meters), Mount Riga (2,000 feet, or 610 meters), and Bradford Mountain (1,962 feet, or 598 meters).

Rivers, Waterfalls, and Lakes. The Connecticut River flows south through the center of the state. It is Connecticut's chief river. Some ocean-going ships can sail on the Connecticut as far north as Hartford, 50 miles (80 kilometers) inland. The Housatonic River and its chief tributaries, the Naugatuck and Shepaug rivers, drain the Western New England Upland. The Thames and the Quinebaug are the chief rivers of eastern Connecticut. Connecticut has many small waterfalls. Kent Falls, the largest, plunges about 200 feet (61 meters) along a distance of about $\frac{1}{4}$ mile (0.4 kilometer) near Kent.

Over 1,000 lakes dot the landscape. Most are small. Several of the largest ones are used as reservoirs. Others provide recreation activities. The largest lake, Lake Candlewood, is man-made. It was created to store water for generating power. Other lakes include Bantam, Pachaug, Shenipsit, Twin Lakes, and Waramaug.

Larry Keighley, Alpha Photo Assoc.

Salt Marshes make up part of the Coastal Lowlands region of Connecticut. This area near the Atlantic Ocean is flatter and lower than other parts of the state. It has many harbors.

Forested Hills Rise Above the Fields in Connecticut's Western New England Upland region. The stony soil is best suited for growing hay and other feed crops for livestock.

Arthur Griffin, Alpha Photo Assoc.

The Broad Connecticut River flows through the central part of the state. This ferry crosses the river near Chester. Some ocean ships can go up the river as far as Hartford.

Eric M. Sanford, Alpha Photo Assoc.

The Connecticut Turnpike runs through the broad river valleys and low hills of the Eastern New England Upland region. This traffic interchange provides an exit to the city of Norwich.

Eric M. Sanford, Alpha Photo Assoc.

CONNECTICUT / *Climate*

Connecticut's weather is rarely very cold or very hot. January temperatures average 27° F. (−3° C), and July temperatures average 72° F. (22° C). The state's record low, −32° F. (−36° C), was set in Falls Village on Feb. 16, 1943. The record high, 105° F. (41° C), was set in Waterbury on July 22, 1926.

Yearly *precipitation* (rain, melted snow, and other forms of moisture) in Connecticut averages about 46 inches (117 centimeters). The average rainfall is distributed fairly evenly throughout Connecticut.

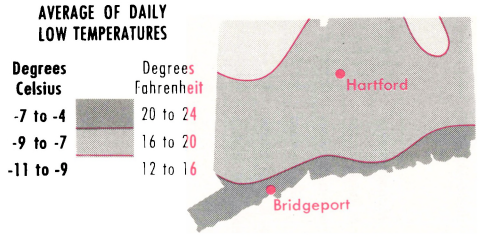
Snowfall averages from about 25 inches (64 centimeters) yearly in the southeast to 35 inches (89 centimeters) in the western and central sections of the state. The highest places in the northwest sometimes receive 80 inches (200 centimeters) of snow annually.

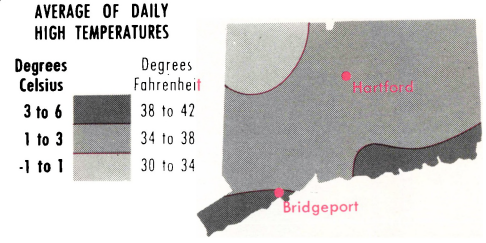
Connecticut State Highway Dept.

Skiers take advantage of the snowfall on Mohawk Mountain near Cornwall. Some parts of northwestern Connecticut receive as much as 80 inches (200 centimeters) of snow annually.

SEASONAL TEMPERATURES

January





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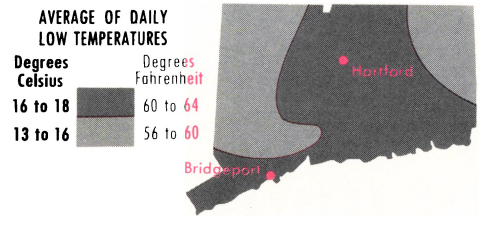
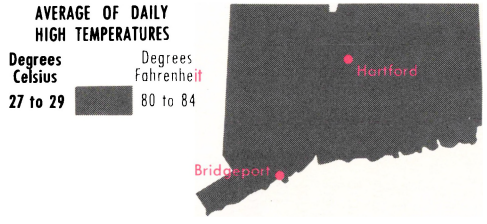
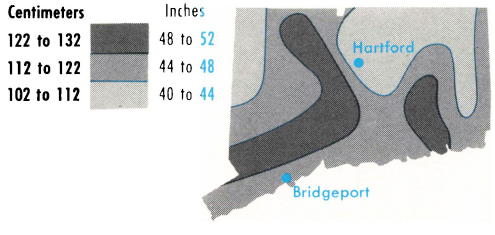




AVERAGE YEARLY PRECIPITATION

(Rain, Melted Snow and Other Moisture)



WORLD BOOK maps

AVERAGE MONTHLY WEATHER

HARTFORD

	Temperatures F° High	Low	Temperatures C° High	Low	Days of Rain or Snow
JAN.	36	18	2	-8	13
FEB.	38	18	3	-8	11
MAR.	47	27	8	-3	12
APR.	60	36	16	2	12
MAY	72	47	22	8	12
JUNE	81	57	27	14	10
JULY	86	62	30	17	10
AUG.	83	60	28	16	10
SEPT.	76	52	24	11	9
OCT.	65	41	18	5	8
NOV.	51	31	11	-1	10
DEC.	39	20	4	-7	11

BRIDGEPORT

	Temperatures F° High	Low	Temperatures C° High	Low	Days of Rain or Snow
JAN.	37	22	3	-6	12
FEB.	37	21	3	-6	10
MAR.	45	29	7	-2	12
APR.	55	37	13	3	13
MAY	67	48	19	9	11
JUNE	76	58	24	14	7
JULY	82	64	28	18	9
AUG.	80	63	27	17	10
SEPT.	74	56	23	13	9
OCT.	64	45	18	7	7
NOV.	52	35	11	2	9
DEC.	40	25	4	-4	10

Manufacturing is by far Connecticut's most important economic activity. Agriculture ranks second in the value of goods produced. Tourism is also important to Connecticut's economy. Manufacturing is centered in Fairfield, Hartford, and New Haven counties. More than half the state's industrial labor force works in 10 cities—Bridgeport, East Hartford, Groton, Hartford, New Britain, New Haven, Norwalk, Stamford, Stratford, and Waterbury. Farms and the tourist trade thrive in many parts of Connecticut. About 15 million tourists contribute about $375 million yearly to the state's economy.

Natural Resources. Unlike many other states, Connecticut does not depend chiefly on its own natural resources for the raw materials of its industries. The state has many forests, but they are not commercially important. Connecticut lacks large deposits of valuable minerals, and much of the soil is unsuitable for farming.

Soil. Some of the soils at Connecticut's low elevations are dry. But they produce good vegetable and tobacco crops. Much of the soil in the uplands is stony. It is best suited for growing grass that can be made into hay or used as cattle feed.

Forests cover about 70 per cent of the land in Connecticut. Unlike many other states, Connecticut does not use its forests primarily to support a wood-processing industry. Most of its trees are too small to be valuable in industry. Its forests are used mainly as recreation and water conservation areas. Connecticut trees include the ash, beech, birch, elm, hemlock, hickory, maple, oak, red and white pine, and tulip tree.

Plant Life. The mountain laurel, Connecticut's state flower, grows throughout the woodlands and along roads. Many persons in western Connecticut call this flowering shrub *ivy*. Pink and white dogwood grow throughout Connecticut. Bayberry, sheep laurel, and sweet fern cover many fields.

Animal Life of Connecticut consists chiefly of small creatures. The animals most prized by hunters and trappers include foxes, hares, minks, muskrats, otters, and rabbits. The fresh-water duck is Connecticut's most common game bird. Partridges, ring-necked pheasants, and ruffed grouse are also hunted. Orioles, sparrows, thrushes, and warblers live in the state.

Connecticut waters in Long Island Sound have many clams, flounder, lobsters, and oysters. Shad is the leading fish of the state's inland waterways.

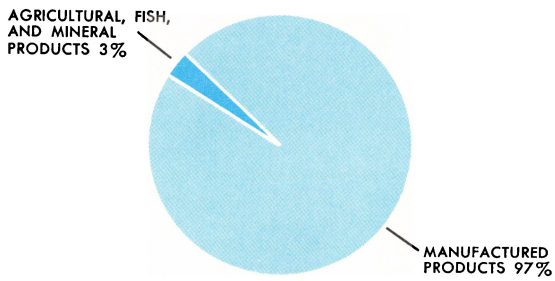
Minerals. Stone—especially a kind of basalt called traprock—and sand and gravel are Connecticut's leading minerals. Clays, feldspar, and mica are also found.

Manufacturing accounts for about 97 per cent of the value of goods produced in Connecticut. Goods manufactured there have a *value added by manufacture* of about $5 billion a year. This figure represents the value created in products by Connecticut industries, not counting such costs as materials, supplies, and fuel.

Manufacturing industries employ about 400,000 workers, or 35 per cent of Connecticut's labor force. This percentage is higher than that of any other state. The chief kinds of manufactured goods produced in Connecticut are, in order of importance: (1) transportation equipment, (2) nonelectrical machinery, (3) electrical machinery, and (4) fabricated metal products.

PRODUCTION OF GOODS IN CONNECTICUT

Total value of goods produced in 1971—$6,241,836,000



Percentages are based on farm income, value added by manufacture, and value of fish and mineral production. Fish and mineral products are each less than 1 per cent.
Sources: U.S. government publications, 1971-1973.

EMPLOYMENT IN CONNECTICUT

Total number of persons employed in 1972—1,199,000

	Number of Employees
Manufacturing	402,000
Wholesale & Retail Trade	233,500
Community, Business, & Personal Services	198,500
Government	164,400
Finance, Insurance, & Real Estate	78,300
Construction & Mining	55,800
Transportation & Public Utilities	53,600
Agriculture	13,000

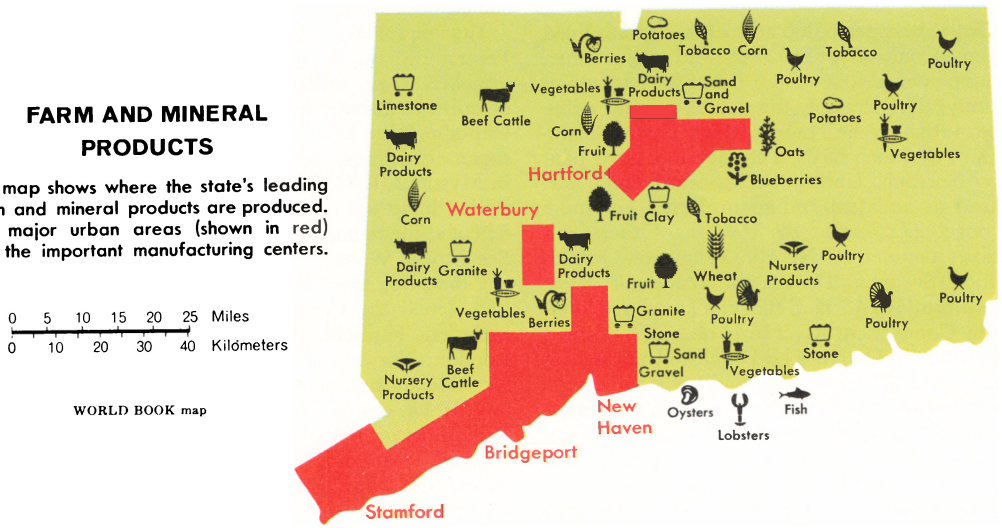
Sources: *Employment and Earnings*, May, 1973, U.S. Bureau of Labor Statistics; U.S. Bureau of Employment Security.

Transportation Equipment has a value added of about $1 billion yearly. Connecticut is a leading state in making helicopters, jet aircraft engines, propellers, and submarines. Factories in Bloomfield, Plainfield, and Stratford turn out helicopters. Jet aircraft engines are made in East Hartford, North Haven, Southington, and Stratford. Groton is a major submarine-making center, and propellers come from Windsor Locks. Small boats are built in Essex, Mystic, and Noank.

Nonelectrical Machinery has a value added of about $815 million annually. Factories in many parts of Connecticut make machine tools such as grinders, lathes, and planers. The state is a leading U.S. manufacturer of ball and roller bearings.

Electrical Machinery has a yearly value added of about $675 million. Connecticut ranks among the top U.S. producers of electrical conductors, outlets, and switches. The state's wide variety of electrical products also includes generators, household appliances, lighting fixtures, and motors.

Fabricated Metal Products have a value added of about $645 million yearly. Connecticut ranks high among the states in the production of cutlery and hardware. Other metal products include bolts, nuts, rivets, washers, and valve and pipe fittings. New Britain and New Haven are important hardware centers.



Other Products. Connecticut is also a leading state in processing copper and in making silverware. Silverware comes from Meriden and Wallingford. The state also ranks high in the production of clocks and optical instruments. Connecticut's long list of manufactured goods includes chemicals, clothing, and plastics and rubber products.

Agriculture accounts for less than 3 per cent of the value of goods produced in Connecticut. The state's farmers earn about $160 million a year. Connecticut's 4,500 farms average about 120 acres (49 hectares) in size.

Dairy products, especially milk, earn about 30 per cent of Connecticut's farm income. Poultry products, especially eggs, earn about 25 per cent. A number of Connecticut farmers raise *broilers* (chickens 9 to 12 weeks old).

Tobacco, Connecticut's leading field crop, accounts for about a sixth of the total farm income. Many farmers in the Connecticut Valley raise shade-grown tobacco, the most expensive tobacco leaf grown in the United States. It is used as the outer wrapping of cigars. Apples are by far the most important fruit grown in Connecticut. Other fruits include peaches, pears, and strawberries.

Greenhouse and nursery products provide about 15 per cent of Connecticut's farm income. These products include ornamental shrubs, flowers, and vegetable plants.

Mining contributes about $30 million a year to the value of goods produced in Connecticut. This figure represents less than half of 1 per cent of the state's total production. Stone, especially traprock, is Connecticut's most valuable mineral. Sand and gravel rank next in importance. Clays, feldspar, gemstones, granite, limestone, and mica are also mined.

Fishing Industry has relatively little importance in Connecticut today. About 27,000 acres (10,900 hectares) of oyster beds lie in Long Island Sound off the Connecticut coast. Connecticut fishermen catch oysters, flounder, lobsters, and hard-shelled clams. Shad fishing is centered on the Connecticut River.

Electric Power. Steam-powered plants, fueled by coal or oil, supply more than 95 per cent of Connecticut's electric power. Most of the rest comes from hydroelectric plants. A small part of the power is generated by atomic energy.

Transportation. Connecticut has about 18,000 miles (29,000 kilometers) of roads and highways, most of which are surfaced. The 129-mile (208-kilometer) Connecticut Turnpike crosses the state from the New York border, near Greenwich, to the Rhode Island border, near Killingly.

The Hartford and New Haven, Connecticut's first important railroad, began service between New Haven and Meriden in 1838. Today, two railroads operating on about 665 miles (1,070 kilometers) of track in the state provide freight service. Passenger trains serve more than 20 cities and towns in Connecticut. Some of these trains carry thousands of Connecticut commuters to and from their jobs in New York City.

More than 75 airports serve Connecticut. Bradley International Airport in Windsor Locks provides direct air passenger service between Connecticut and about 50 U.S. cities.

Bridgeport, New Haven, and New London are important seaports. They handle about 20 million short tons (18 million metric tons) of cargo yearly.

Communication. About 95 newspapers, including 25 dailies, are published in Connecticut. The *Connecticut Courant* (now *The Hartford Courant*) began publication in 1764. It is one of the oldest continuously published newspapers in the United States. The *Courant* and the *Bridgeport Post*, *Hartford Times*, *New Haven Register*, and *Waterbury American* are among Connecticut's chief newspapers.

Connecticut has about 60 radio stations and 8 television stations. The state's first radio station, WDRC, opened in Hartford in 1922. The first television station, WNHC, began operating in New Haven in 1948.

Indian Days. Between 6,000 and 7,000 Indians lived in what is now Connecticut before the white man came. The Indians belonged to several tribes of the Algonkian Indian family. The Pequot, the most powerful tribe, lived in the south near the Thames River. The Mohegan (or Mohican), a branch of the Pequot tribe, lived near present-day Norwich. Uncas, the Mohegan chief, was characterized as an ideal Indian in James Fenimore Cooper's novel *The Last of the Mohicans*. Other Connecticut tribes included the Niantic, Paugusset, Quinnipiac, Saukiog, Siwanog, Tunxis, and Wangunk.

Dutch Exploration. Adriaen Block, a Dutch explorer, sailed up the Connecticut River in 1614. Block claimed Connecticut for the Dutch. The Dutch did not act on this claim until 1633 when they built a small fort—called the *House of Hope*—on the present site of Hartford. But the Dutch never settled permanently in Connecticut. They claimed parts of Connecticut off and on until 1674, when the English finally drove them out.

English Settlement. Englishmen from Massachusetts made Connecticut's earliest permanent settlements. Windsor, the first one, was founded in 1633. Other early settlements included Hartford, New Haven, New London, Saybrook, and Wethersfield. Hartford, Wethersfield, and Windsor united in 1636 to form the *Connecticut Colony* (also called the *River Colony*).

Many early Connecticut settlers left Massachusetts in search of political and religious freedom. The most famous of these settlers was Thomas Hooker, a Congregationalist minister and the chief founder of Hartford. In 1638, Hooker preached a sermon calling for government based on the will of the people. The Connecticut Colony put Hooker's principle into practice in 1639, when it adopted the *Fundamental Orders* as its law. The Fundamental Orders gave voters the right to elect government officials. The Fundamental Orders are sometimes called the *first written constitution*.

The Pequot War. The Connecticut colonists feared the Pequot Indians because small bands of the tribe had attacked their settlements. The Pequot feared the colonists as a threat to Pequot supremacy in the region. Captain John Mason, aided by Mohegan and Narraganset warriors, led a small army against the Pequot in Mystic in 1637. Mason's men burned a Pequot fort, killing hundreds of Indians. That same year, colonists defeated the remaining Pequot in a fight near Fairfield. See INDIAN WARS (The Pequot War).

Expanding the Colony. By 1660, several new towns had joined the Connecticut Colony. The new towns included Fairfield, Farmington, Middletown, New London, Norwalk, Saybrook, and Stratford. In 1638, New Haven had been founded as an independent colony. It was originally a Puritan *theocracy* (church-state). Beginning in 1643, the towns of Branford, Guilford, Milford, Stamford, and Southold (on Long Island) joined the New Haven Colony. As a result, Connecticut consisted of two colonies—the Connecticut Colony and the New Haven Colony.

In 1662, John Winthrop, Jr., of the Connecticut Colony received a charter from the king of England. The charter gave the colony a strip of land 73 miles (117 kilometers) wide from Narragansett Bay to the Pacific Ocean. It included the New Haven Colony.

IMPORTANT DATES IN CONNECTICUT

1614 Adriaen Block claimed Connecticut for the Dutch.

1633 The first English settlement in Connecticut was made in Windsor.

1636 The towns of Hartford, Wethersfield, and Windsor united to form the Connecticut Colony.

1637 Connecticut and other colonies defeated the Pequot Indians in the Pequot War.

1638 A group of wealthy Puritans founded New Haven.

1639 The Connecticut Colony adopted the Fundamental Orders.

1662 The Connecticut Colony received a charter from England. It served as Connecticut's constitution until 1818.

1665 The Connecticut and New Haven colonies united.

1687 Colonists preserved the Connecticut charter by hiding it, presumably in the Charter Oak in Hartford.

1776 Connecticut passed a resolution in favor of independence from Great Britain on June 14.

1788 Connecticut became the 5th state when it ratified the U.S. Constitution on January 9.

1910 The U.S. Coast Guard Academy was moved to New London.

1954 The first atomic submarine was launched in Groton.

1965 Connecticut apportioned its legislature on the basis of population. Connecticut adopted a new constitution.

1971 Connecticut adopted a lottery to raise additional revenue for state government expenses. The lottery went into effect in 1972.

Yankee Peddlers traveled far and wide during the 1700's. They spread the fame of the state's craftsmen by selling such Connecticut products as brassware, buttons, clocks, combs, firearms, hats, pins, and tinware.

HISTORIC CONNECTICUT

The Fundamental Orders of Connecticut were adopted in 1639. These laws set forth the idea of government by consent of the people.

At first, New Haven objected to being part of the Connecticut Colony. But the two colonies united in 1665.

Colonial Life. The earliest Connecticut colonists were farmers. Most of them raised only enough food for their own needs. Each family made most of its own clothing, household utensils, and farm tools.

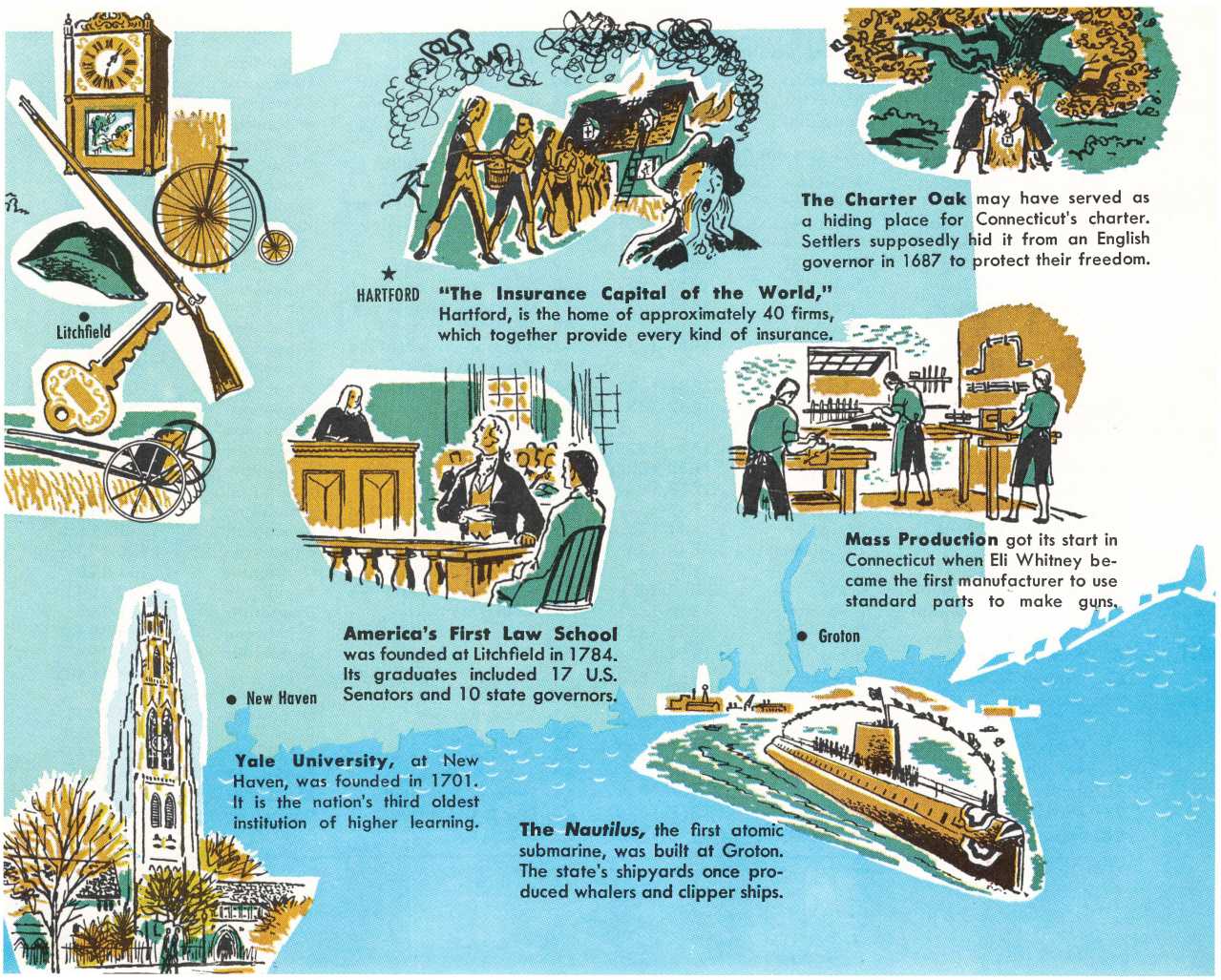
During the late 1600's, Connecticut began exporting farm products to other lands, especially to the West Indies. Manufacturing started in Connecticut during the early 1700's. Clockmaking, shipbuilding, and silversmithing were the first important industries. Two brothers, Edward and William Pattison, made the first tinware in North America in the 1740's. The Pattison brothers became the first of Connecticut's famous *Yankee peddlers*. These house-to-house salesmen traveled in small carts selling a variety of Connecticut products. They were such shrewd businessmen that stories arose accusing them of selling wooden nutmegs. The stories gave Connecticut the nickname of the *Nutmeg State*.

Defending the Colony. Sir Edmund Andros, named by the English king as governor of several other New England colonies, twice tried to gain control of Connecticut. In 1675, he sent troops to seize a fort in Saybrook. But his forces withdrew because Connecticut resisted strongly and the soldiers wanted to avoid a bloody battle. In 1687, Andros arrived in Hartford and demanded Connecticut's charter. But the people refused to give it to him. They supposedly hid the charter in a large oak tree, later called the Charter Oak.

The Revolutionary War. During the 1760's, Great Britain passed a series of laws that caused unrest in Connecticut and the other American colonies. Some of these laws set up severe taxes and restricted colonial trade. A few Connecticut men urged loyalty to Britain. But the great majority favored independence.

After the Revolutionary War began in Massachusetts in 1775, hundreds of Connecticut men joined the patriot forces. Governor Jonathan Trumbull and Nathan Hale rank among the most famous Connecticut patriots. Trumbull was the only colonial governor to hold office throughout the Revolution. He worked hard to supply men, food, and equipment for the patriot army. He became a close friend and trusted adviser of General George Washington. Often, when in need of advice or supplies, Washington said: "We must ask Brother Jonathan." *Brother Jonathan* was Washington's nickname for Trumbull (see BROTHER JONATHAN). Nathan Hale was hanged by the British as a spy. His dying words won him lasting fame: "I only regret that I have but one life to lose for my country."

Connecticut passed a resolution favoring independence from Britain on June 14, 1776. On July 4, the 13 colonies adopted the Declaration of Independence. On July 9, 1778, Connecticut *ratified* (approved) the Articles of Confederation, the forerunner of the United



States Constitution. The colony became a state on Jan. 9, 1788, when it ratified the U.S. Constitution. Connecticut was the fifth state to join the Union.

Roger Sherman of Connecticut broke a deadlock that threatened to break up the Constitutional Convention of 1787. Convention delegates from large states wanted a state's representation in Congress to be determined by population. Delegates from small states wanted all states to have equal representation in Congress. Sherman worked out the *Connecticut Compromise*, which the Convention approved. The compromise established the present two-house U.S. Congress. Representation in the House of Representatives is based on population. All the states have equal representation in the Senate.

During the 1780's, Connecticut gave up claims to most of the western land that the colony had been granted in the 1662 charter. Connecticut kept only its claim to the Western Reserve. Most of this land in northeastern Ohio was sold to the Connecticut Land Company in 1795. The money was used for education.

The 1800's. Until the 1850's, most of Connecticut's people continued to work on farms. But before 1900, Connecticut had become a thriving industrial state.

Connecticut owes much of its industrial importance to the inventors who worked there. Perhaps the most important of these inventors was Eli Whitney. Whitney is best known as the inventor of the cotton gin. But he was also the father of mass-production manufacturing. While working in Hamden about 1800, Whitney built machine tools that made interchangeable gun parts. Until then, all gun parts were handmade, and part of one gun usually would not fit another gun.

In 1808, Eli Terry of East Hartford became the first person to make clocks by mass production. In 1810, Rodney Hanks and his nephew, Horatio Hanks, built the nation's first silk mill in Mansfield. Samuel Colt of Hartford invented the first successful repeating pistol, and obtained a U.S. patent for it in 1836. Colt made pistols and other firearms in his Hartford factory. In 1839, Charles Goodyear of Connecticut found a way to *vulcanize* (strengthen) rubber. He patented his method in 1844. Connecticut men also pioneered in making bicycles, cigars, copper coins, nuts and bolts, pins and needles, silk thread, and rubber shoes.

Improved transportation helped Connecticut grow industrially. Fifteen railroad companies were organized in the state between the 1830's and 1850's. Steamships began serving Connecticut ports in the early 1800's. With these facilities, industries could import large quantities of raw materials inexpensively. Connecticut's industrial growth also was aided by thousands of Canadian and European immigrants. These workers provided relatively inexpensive factory labor.

THE GOVERNORS OF CONNECTICUT

	Party	Term
Under Articles of Confederation		
1. Jonathan Trumbull	Federalist	1778-1784*
2. Matthew Griswold	Federalist	1784-1786
3. Samuel Huntington	Federalist	1786-1788
Under United States Constitution		
1. Samuel Huntington	Federalist	1788-1796
2. Oliver Wolcott	Federalist	1796-1797
3. Jonathan Trumbull II	Federalist	1797-1809
4. John Treadwell	Federalist	1809-1811
5. Roger Griswold	Federalist	1811-1812
6. John Cotton Smith	Federalist	1812-1817
7. Oliver Wolcott, Jr.	Toleration	1817-1827
8. Gideon Tomlinson	National Republican	1827-1831
9. John S. Peters	National Republican	1831-1833
10. Henry W. Edwards	Democratic	1833-1834
11. Samuel A. Foot	National Republican	1834-1835
12. Henry W. Edwards	Democratic	1835-1838
13. William W. Ellsworth	Whig	1838-1842
14. Chauncey F. Cleveland	Democratic	1842-1844
15. Roger S. Baldwin	Whig	1844-1846
16. Isaac Toucey	Democratic	1846-1847
17. Clark Bissell	Whig	1847-1849
18. Joseph Trumbull	Whig	1849-1850
19. Thomas H. Seymour	Democratic	1850-1853
20. Charles H. Pond	Democratic	1853-1854
21. Henry Dutton	Whig	1854-1855
22. William T. Minor	American†	1855-1857
23. Alexander H. Holley	American and Republican**	1857-1858
24. William A. Buckingham	Republican	1858-1866
25. Joseph R. Hawley	Republican	1866-1867
26. James E. English	Democratic	1867-1869
27. Marshall Jewell	Republican	1869-1870
28. James E. English	Democratic	1870-1871
29. Marshall Jewell	Republican	1871-1873
30. Charles R. Ingersoll	Democratic	1873-1877
31. Richard D. Hubbard	Democratic	1877-1879
32. Charles B. Andrews	Republican	1879-1881
33. Hobart B. Bigelow	Republican	1881-1883
34. Thomas M. Waller	Democratic	1883-1885
35. Henry B. Harrison	Republican	1885-1887
36. Phineas C. Lounsbury	Republican	1887-1889
37. Morgan G. Bulkeley	Republican	1889-1893
38. Luzon B. Morris	Democratic	1893-1895
39. O. Vincent Coffin	Republican	1895-1897
40. Lorrin A. Cooke	Republican	1897-1899
41. George E. Lounsbury	Republican	1899-1901
42. George P. McLean	Republican	1901-1903
43. Abiram Chamberlain	Republican	1903-1905
44. Henry Roberts	Republican	1905-1907
45. Rollin S. Woodruff	Republican	1907-1909
46. George L. Lilley	Republican	1909
47. Frank B. Weeks	Republican	1909-1911
48. Simeon E. Baldwin	Democratic	1911-1915
49. Marcus H. Holcomb	Republican	1915-1921
50. Everett J. Lake	Republican	1921-1923
51. Charles A. Templeton	Republican	1923-1925
52. Hiram Bingham	Republican	1925
53. John H. Trumbull	Republican	1925-1931
54. Wilbur L. Cross	Democratic	1931-1939
55. Raymond E. Baldwin	Republican	1939-1941
56. Robert A. Hurley	Democratic	1941-1943
57. Raymond E. Baldwin	Republican	1943-1946
58. Wilbert Snow	Democratic	1946-1947
59. James L. McConaughy	Republican	1947-1948
60. James C. Shannon	Republican	1948-1949
61. Chester Bowles	Democratic	1949-1951
62. John Lodge	Republican	1951-1955
63. Abraham A. Ribicoff	Democratic	1955-1961
64. John N. Dempsey	Democratic	1961-1971
65. Thomas J. Meskill	Republican	1971-1975
66. Ella T. Grasso	Democratic	1975-

*Term began in 1769 †Sometimes called Know-Nothing **Sometimes called Know-Nothing Republican

The Early 1900's. Many immigrants settled in Connecticut during the late 1800's and early 1900's. By 1910, about 30 per cent of the state's population was made up of persons born outside the United States. Most of them settled in cities. By 1910, almost 90 per cent of Connecticut's people lived in urban areas.

In 1910, the U.S. Coast Guard Academy was moved to New London from headquarters in Maryland and Massachusetts. The U.S. Navy opened a submarine base in nearby Groton in 1917. After the United States entered World War I in 1917, many of the nation's largest munitions factories operated in Connecticut. About 67,600 Connecticut men served in the armed forces during the war.

Connecticut industry continued to grow during the 1920's. At the same time, the Republican party controlled Connecticut politics. The Great Depression of the 1930's slowed industry and caused widespread unemployment in Connecticut. The depression swung many Connecticut voters over to the Democratic party. Democrat Wilbur Cross won election as governor four times during the 1930's. Economic conditions improved when the depression eased in the late 1930's.

The Mid-1900's. During World War II (1939-1945), Connecticut was an important supplier of war materials. The state's factories made airplane engines, propellers, shell cases, and submarines.

Connecticut industry kept pace with the atomic age and space age during the 1950's and 1960's. In 1954, the *Nautilus*, the world's first nuclear-powered submarine, was built and launched at Groton. In the late 1960's, the Groton shipyard began to build nuclear submarines armed with more powerful missile weapons. An atomic energy plant for the production of electric power began to operate at Haddam Neck in 1968.

Also in the 1960's, Stratford plants produced re-entry vehicles for spacecraft, and Middletown factories made small tape recorders to send signals into outer space. In 1969, when U.S. astronauts became the first men to walk on the moon, they carried oxygen and other supplies in backpacks made in Connecticut.

From 1950 to 1960, Connecticut's population increased more than that of any other New England state. The 1950's and 1960's also brought changes in the state government. In 1955, the Connecticut legislature approved new laws that gave voters a direct voice in choosing candidates for state elections. In 1964, Connecticut redrew the boundaries of its congressional districts. Six new districts with more equal populations were created for congressional elections.

Also in 1964, a federal court ruled against Connecticut's 327-year-old system for electing state legislators. Under this system, each town, regardless of its population, could elect at least one legislator. As a result, 10 per cent of the voters could elect a majority of the state representatives. This was possible because many thinly populated areas elected as many representatives as did heavily populated areas. In 1965, Connecticut *reapportioned* (redivided) its legislative districts to provide representation based on population. The Democrats, who were stronger in the large population centers, gained power.

Connecticut adopted its present constitution in 1965. The constitution requires that the legislature be reapportioned after each federal census.

During the 1950's and 1960's, many Connecticut communities tore down slum sections and replaced them with new buildings. For example, the construction of Hartford's Constitution Plaza turned a slum into an attractive business district. State spending for education, welfare, and other citizen services rose rapidly.

Connecticut Today ranks first among the states in *per capita* (per person) income. But rapid industrial and population growth has brought many problems to Connecticut in the 1970's. Cities and highways are crowded. Costs for education and housing are soaring. Racial disorders broke out in Hartford, Middletown, New Haven, and Waterbury in the late 1960's.

Protecting Connecticut against pollution has become a major challenge. In the late 1960's and early 1970's, the state legislature passed laws to reduce air and water pollution. Efforts are being made to attack metropolitan problems on a regional basis. For example, the 29 towns of the Capitol (Hartford) Region are attempting to stop the sale of illegal drugs and to provide treatment for drug users. The towns are also working together on a joint library program and other projects.

Connecticut reapportioned its legislature in 1971. That year, the legislature also passed the state's first individual income tax. But after public protests, the legislature repealed the tax and raised taxes on cigarettes, gasoline, and general sales. The state legislature established a lottery in 1971 to raise additional revenue. The lottery began operating in 1972.

BOB EDDY, JOSEPH B. HOYT, and ALBERT E. VAN DUSEN

CONNECTICUT / *Study Aids*

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HISTORY

Charter Oak
Colonial Life in America
Hartford Convention
Mystic Seaport
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PHYSICAL FEATURES

Connecticut River
Housatonic River
Long Island Sound
New England

CONNECTICUT, UNIVERSITY OF

OTHER RELATED ARTICLES

New London Naval Submarine Base
United States Coast Guard Academy

Outline

I. Government
   A. Constitution
   B. Executive
   C. Legislature
   D. Courts
   E. Local Government
   F. Taxation
   G. Politics
II. People
III. Education
   A. Schools
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IV. A Visitor's Guide
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VI. Climate
VII. Economy
   A. Natural Resources
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   C. Agriculture
   D. Mining
   E. Fishing Industry
   F. Electric Power
   G. Transportation
   H. Communication
VIII. History

Questions

Why is Connecticut called the *Constitution State?*
What is Connecticut's chief economic activity?
What problems are some Connecticut towns attempting to solve on a regional basis?
What were the *Fundamental Orders?*
How did Connecticut provide its first school fund?
What technique first used in Connecticut led to modern manufacturing methods?
Who was *Brother Jonathan?*
Which city in Connecticut is called the *Insurance Capital of the World?*
What defense products are made in Connecticut?
In what way are Connecticut counties unusual?

Books for Young Readers

BAILEY, BERNADINE F. *Picture Book of Connecticut.* Rev. ed. Whitman, 1966.

CARPENTER, ALLAN. *Connecticut.* Childrens Press, 1966.

JOHNSTON, JOHANNA. *The Connecticut Colony.* Macmillan, 1969.

SPEARE, ELIZABETH G. *The Witch of Blackbird Pond.* Houghton, 1958. Fiction. Newbery medal winner.

Books for Older Readers

BUSHMAN, RICHARD L. *From Puritan to Yankee: Character and the Social Order in Connecticut, 1690-1765.* Harvard, 1967.

COLLIER, CHRISTOPHER. *Roger Sherman's Connecticut: Yankee Politics and the American Revolution.* Wesleyan Univ. Press, 1971.

VAN DUSEN, ALBERT E. *Connecticut.* Random House, 1961.

CONNECTICUT, UNIVERSITY OF, is a state-supported coeducational university in Storrs, Conn. Schools and colleges at the university include agriculture, business administration, education, engineering, fine arts, home economics, liberal arts and sciences, nursing, pharmacy, and physical therapy. The university has branches in Groton, Hartford, Stamford, Torrington, and Waterbury, and maintains schools of insurance, law, medicine, and social work in Greater Hartford. The school of dentistry is in Farmington, near Hartford. Courses at the university lead to bachelor's, master's, and doctor's degrees. It was founded as a land-grant college in 1881. For enrollment, see UNIVERSITIES AND COLLEGES (table). DONALD W. FRIEDMAN

CONNECTICUT COLLEGE. See UNIVERSITIES AND COLLEGES (table).

CONNECTICUT COMPROMISE. See CONSTITUTION OF THE UNITED STATES (The Compromises).

CONNECTICUT RIVER rises in northern New Hampshire, and forms the boundary between that state and Vermont. It then cuts across Massachusetts and Connecticut to empty into Long Island Sound. The Connecticut River is 407 miles (655 kilometers) long. Industrial towns grew up along its middle course to take advantage of the power from the river's falls and rapids. Important industries along the river include textile mills and paper plants. JOHN H. GARLAND

CONNECTIVE TISSUE connects body organs and tissues, holds organs in place, and supports the body. Compared with other types of tissue, connective tissue has relatively few cells and much *intercellular substance* (material outside the cells). Scientists divide connective tissue into three groups, according to the hardness of the intercellular substance. These groups are (1) soft *connective tissue proper*, (2) firm *cartilage*, and (3) hard *bone*. This article discusses connective tissue proper. For information on the other kinds of connective tissue, see the WORLD BOOK articles on BONE and CARTILAGE.

There are two chief types of connective tissue proper —*loose* and *dense*. Loose connective tissue forms the networks of thin fibers that surround such organs as the heart and lungs. It also is found under the skin and over the muscles. Dense connective tissue has more fibers and greater strength than does loose connective tissue. It forms tough capsulelike coverings that keep such organs as the kidneys in place. Dense connective tissue also forms the *ligaments*, which hold the bones and joints in place, and the *tendons*, which connect the muscles to the bones (see LIGAMENT; TENDON).

In addition, connective tissue proper stores fat cells. Specialized kinds of this tissue called *reticular* tissue manufacture red and white blood cells.

The intercellular substance of connective tissue proper consists of long fibers mixed with a jellylike material. The fibers may be either white or yellow. White fibers, which outnumber the yellow ones in most connective tissue, are made of a protein called *collagen*. Most white fibers resemble strong cords. Some white fibers form strands of delicate reticular tissue. The yellow fibers are made of a protein called *elastin*, which stretches easily. LEONARD MARMOR

CONNELLY, MARC (1890-), is the author of *The Green Pastures* (1930), perhaps America's most popular religious drama. The play has an all-Negro cast and is written in the homespun language of the Negro South. It takes place in heaven, and God (called "De Lawd" in the play) is the chief character. "De Lawd" changes from the Old Testament God of wrath to a God of mercy. The play is filled with humor and the recognition of the dignity of man. It won a Pulitzer prize in 1930.

Connelly and George S. Kaufman earlier collaborated to write several lively, satirical comedies. But their most significant collaboration was *Beggar on Horseback* (1924), an expressionistic dream play adapted from a German script. The play shows the forces in everyday life that oppose the creative person.

Connelly was born Marcus Cook Connelly in McKeesport, Pa. THOMAS A. ERHARD

CONNOR, RALPH. See GORDON, CHARLES WILLIAM.

CONQUISTADORS, *kahn KWIHS tuh dawrz,* were Spanish explorers who conquered various regions of Latin America in the 1500's. *Conquistador* is a Spanish word meaning *conqueror.* The most famous conquistadors included Hernando Cortes, who took Mexico, and Francisco Pizarro, who conquered Peru. See also EXPLORATION AND DISCOVERY (Exploring the Americas).

CONRAD, CHARLES, JR. (1930-), a United States astronaut, commanded the Apollo 12 mission that made the second manned landing on the moon. On Nov. 19, 1969, Conrad and astronaut Alan L. Bean landed in their lunar module, *Intrepid,* and stayed for 31 hours. Richard F. Gordon, Jr., the third crew member, remained in lunar orbit in the command ship, *Yankee Clipper.* Conrad and Bean set up scientific instruments and collected rock and soil samples. They also removed parts from *Surveyor 3,* an unmanned spacecraft that had landed on the moon in April, 1967.

Conrad was born in Philadelphia on June 2, 1930. He entered the Navy in 1953 after graduating from Princeton University. Conrad completed Navy Test Pilot School and then served as a flight instructor. He became an astronaut in 1962. In 1965, Conrad piloted the Gemini 5 mission with astronaut L. Gordon Cooper, Jr. He commanded the Gemini 11 mission in 1966. In 1974, Conrad retired from the astronaut program and the Navy. He became an executive with a cable television network. WILLIAM J. CROMIE

CONRAD, JOSEPH (1857-1924), was a Polish-born author who wrote in English. He became famous for his novels and short stories about the sea.

Conrad was born Józef Teodor Konrad Nalecz Korzeniowski near Kiev, in what was then Russian Poland. He left Poland at the age of 16 and arrived in England at the age of 20, unable to speak English. During the next 16 years, he worked his way up from deckhand to captain in the British Merchant Navy and so mastered his adopted language that he was able to write some of its greatest novels.

Conrad used experiences of his life in many of his works. From his voyages in the Indian Ocean and Malay Archipelago came some of his best-known novels. He began with *Almayer's Folly* (1895) and *An Outcast of the Islands* (1896), both set in Borneo.

Such later masterpieces as *The Nigger of the "Narcissus"* (1897), *Lord Jim* (1900), *Typhoon* (1903), *Victory* (1915), and *The Shadow Line* (1917) are also set in the eastern seas. Several of his short stories, including "The Secret Sharer" and "Youth," are set there, too. Conrad's story "Heart of Darkness" is based on his voyage up the Congo River, and *Nostromo* (1904) uses memories of his early voyages in the Caribbean.

The people of Conrad's day infuriated him by thinking of him as merely a writer of sea stories. But Conrad knew his works really dealt with universal problems. He used the concentrated little world of a ship to treat the general problem that obsessed him: How can society endure against all the destructive forces of the individual ego and the modern world? *Nostromo,* for example, gives an epic picture of the clash between capitalism and revolution in South America. He also wrote two absorbing novels about revolutionaries in Europe, *The Secret Agent* (1907) and *Under Western Eyes* (1911).

Conrad was not particularly interested in character for its own sake. He was most interested in men who were actively pursuing their aims in life. Some, like the captain of the "Narcissus," triumph over weakness and evil. More often, Conrad's heroes yield to the powers of weakness and evil in themselves and others. But Conrad was not exactly a pessimist. He affirmed the value of the old-fashioned virtues—courage, fidelity, and discipline. He was modern in realizing how enormously difficult it is to practice such virtues. IAN WATT

CONSCIENTIOUS OBJECTOR is a person who claims that his beliefs prevent him from bearing arms in his country's armed forces. A conscientious objector may be willing to serve in the armed forces, but only as a noncombatant, such as a medical corpsman. Or he may claim that his principles do not allow him to take part in any effort associated with war. Of the major countries, only the United States and Britain have consistently accepted the claim of conscientious objection in exempting men from military service and combat training.

In the United States, a conscientious objector may be drafted to serve in a medical corps or some other noncombat branch of military service. Or he may be required to work in a civilian hospital or some other institution serving the national interest.

The history of conscientious objection in the United States dates back to colonial times, when men had to serve in their colony's militia. The first conscientious objectors in America were members of pacifist religious groups, such as the Quakers. In 1661, Massachusetts became the first colony to exempt conscientious objectors from service in its militia. Congress passed the first federal draft law during the Civil War (1861-1865). This law recognized conscientious objectors. To be classified as a conscientious objector, a man had to belong to a pacifist religious group. This requirement was followed during World War I.

The 1940 draft law required "religious training and belief," but not necessarily membership in a pacifist religious group. The 1948 draft law defined religious belief as belief in a "Supreme Being." But Congress removed the term "Supreme Being" in the 1967 law because the Supreme Court of the United States interpreted the term to include vaguely religious philosophies. Between 1967 and 1970, exemptions were granted chiefly to persons whose "religious training and belief" led them to believe all war is wrong.

The religious requirement was strongly questioned during the 1960's. Many men sought exemptions on the basis of their personal philosophy or their belief that the Vietnam War was immoral. In 1970, the Supreme Court ruled that men may qualify for conscientious objector exemptions if they oppose war on strong ethical or moral grounds, even if such opposition is not based on religious belief. The court's interpretation of the draft law exempted from military service "all those whose consciences, spurred by deeply held moral, ethical, or religious beliefs, would give them no rest or peace if they allowed themselves to become part of an instrument of war." HOLBERT N. CARROLL

See also DRAFT, MILITARY (Criticism of the Draft); PACIFISM.

CONSCIOUSNESS. See PSYCHOANALYSIS.

CONSCRIPTION. See DRAFT, MILITARY; ARMY.

Grant Heilman

Soil Conservation helps provide good farmland. *Contour plowing* across sloping land and *strip cropping* (planting different crops in alternate rows) help prevent soil erosion.

Conservation

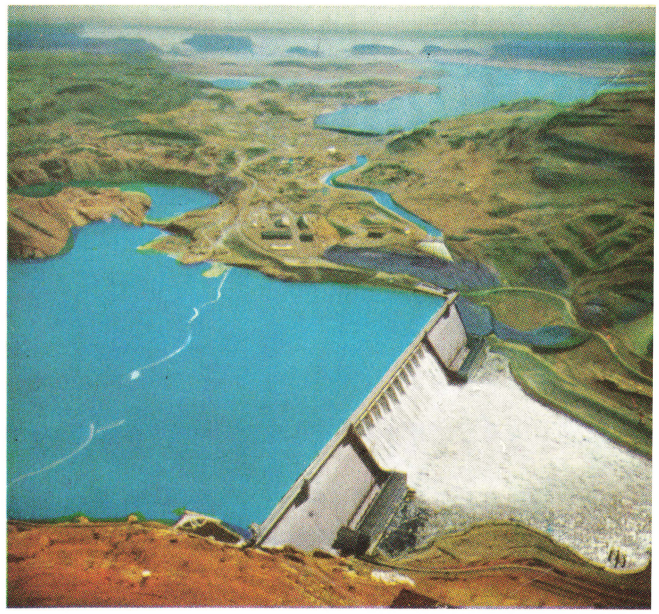
CONSERVATION is the protection and wise management of the environment. People practice conservation so that the environment can provide for their needs and the needs of all other living things. Without conservation, all the resources necessary for life—air, animals, energy, minerals, plants, soil, and water—would be damaged, wasted, or destroyed.

Conservation also involves a concern for the quality of the environment, so that people can enjoy living. It means keeping the environment comfortable and safe—and an interesting, stimulating place in which to live. A healthy environment includes clean streets and highways, with open spaces in cities for parks and playgrounds. Ideal surroundings mean landscapes free of junk and litter. They include wilderness regions where animals and plants can be safe from destruction by human beings.

About 4 billion persons live on the earth, and the world's population grows by about 81 million yearly. The total population increases by about 220,000 every day. All these people need clean water, food, and living space. People once thought the earth could provide enough space and resources for all time. But today we know that the earth has only a limited supply of most resources. For example, only three-tenths of the earth's surface is land, and water covers the rest. Much of the land is too cold, too hot, too mountainous, or too wet for growing crops. As a result, less than 1 acre (0.4 hectare) of land remains to provide food for each person on the earth.

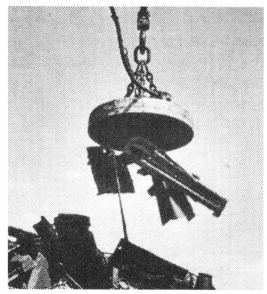
The earth not only has limited resources, but the demands that people make on them increase daily as the population grows. In addition, people have carelessly damaged many of the earth's resources. They have overworked the soil, cut down trees, killed

Raymond F. Dasmann, the contributor of this article, is Senior Ecologist of the International Union for the Conservation of Nature and Natural Resources, and the author of Environmental Conservation.



William A. Garnett

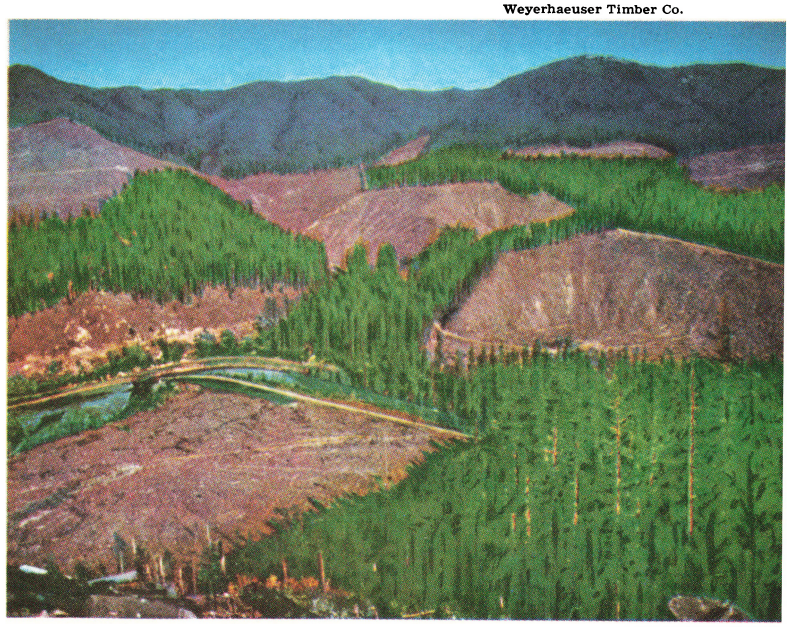
Water Conservation involves management of water supplies. Such dams as Grand Coulee, *above*, in Washington furnish water to irrigate farmland and use it to generate electric power.



Mineral Conservation fights waste by reusing some minerals. Scrap metal, *right*, can be melted down and used again.

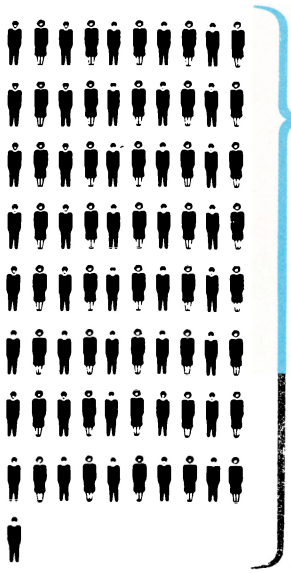
U.S. Steel Corp.; Grand Rapids *Herald Review*

Weyerhaeuser Timber Co.



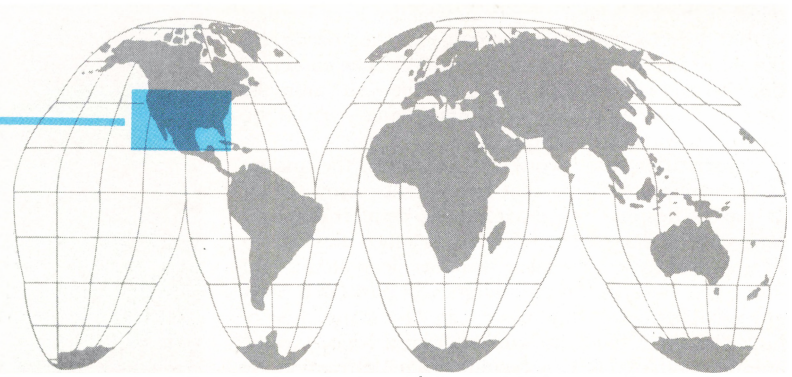
Forests offer recreation, provide homes for wildlife, and supply wood. Block cutting of Douglas firs, *right*, ensures continued production of wood without destroying a forest.

Wildlife Conservation saved the American buffalo from destruction. By the late 1800's, hunters had killed all but about 550 of these animals. The government then passed laws to protect the herds. Today, about 10,000 buffalo live in the Western United States.

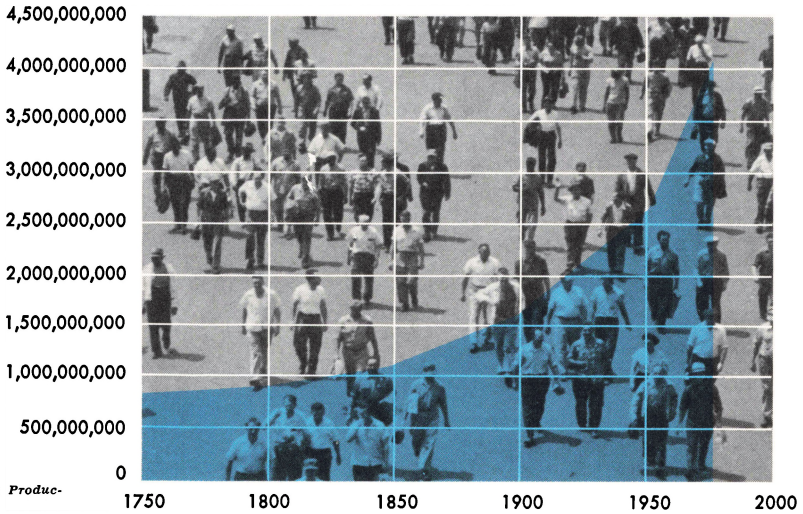


Each figure represents 50,000,000 persons.

The Booming World Population makes it vital to conserve our resources for future generations. In the last 200 years, the number of persons living on the earth has increased about 5 times.



Shortage of Land. The world has only about 9/10 acre (0.36 hectare) of cultivated land to provide food for each of the 4,038,000,000 persons who live on the earth. If all this land were in one place, it would cover only the area shown in blue on the map, *above*.



Sources: *Demographic Yearbook, 1972*, UN; *Production Yearbook, 1972*, FAO.

countless animals, and polluted the air and water.

No one knows how many people the earth can support. But many conservationists believe that the rate of population growth must slow down to decrease the demands made on natural resources. They also believe that people must use resources more wisely than ever before. People must also find new ways to provide for their needs without destroying the environment.

The challenge of conservation faces everyone in his daily life. It also faces neighborhoods; local, state, and national governments; and world organizations, such as the United Nations (UN).

Kinds of Conservation

There are eight main kinds of conservation: (1) soil conservation, (2) water conservation, (3) forest conservation, (4) wildlife conservation, (5) conservation of grazing lands, (6) mineral conservation, (7) conservation for recreation, and (8) conservation in urban areas.

Each type of conservation has its own problems and solutions. But all are related because various resources depend on one another. For example, the strip mining of coal can destroy whole hillsides. Also, when coal is burned, it causes air pollution. Air pollution can kill plants. Without plants, water runs off the land faster, causing soil erosion and perhaps floods.

Soil Conservation. Most of the food that supports life comes from the soil, either directly or indirectly. President Theodore Roosevelt once said: "When the soil is gone, man must go. And the process does not take long." The earth is a great ball of rock about 8,000 miles (13,000 kilometers) in diameter. But its thin surface of soil averages only 2 to 3 feet (61 to 91 centimeters) thick. The depth of the *topsoil*, the fertile top layer, is usually less than 1 foot (30 centimeters). See Soil.

It takes nature several hundred years to build 1 inch (2.5 centimeters) of topsoil. But erosion can wash or blow away this soil in a few years or even weeks. Rain falling on 1 acre (0.4 hectare) of barren, sloping land can wash away as much as 60 truckloads of soil in a year. Such washing away is called *sheet erosion*. Water can also carve gullies in hillsides. Wind may blow the topsoil off both sloping and level land. In the United States, erosion has destroyed an estimated 50 million acres (20 million hectares) of farmland since colonial times. This is an area larger than Nebraska. Erosion has partially destroyed another 50 million acres and threatens about 100 million acres (40 million hectares).

Other processes besides erosion can make soil lose its fertility. Heavy rainfall can *leach out* the minerals that plants need to grow. In leaching, rain water seeps through the soil and carries dissolved minerals below the roots of most plants. Farmers can also ruin their land if they grow crops without *fertilizing*, or returning needed food elements to the soil.

Wise farmers add chemical and natural fertilizers to the soil to maintain the food supply needed by growing plants. They plow animal manure and green plants into the ground to increase the plant food and humus (see HUMUS). *Crop rotation* is an important way of keeping soil fertile. When a farmer rotates his crops, for example, he may alternate corn with other crops that use different elements from the soil. He avoids planting the same crop on the same land year after year. See CROPPING SYSTEM.

Soil conservation tries to keep the soil deep and productive. In *contour plowing*, a farmer plows his furrows across a slope, rather than up and down. The furrows catch the rain water and keep it from running off the hill. Some farmers lay out their fields in *stairstep terraces* on a hillside. Deep gullies can be controlled by planting trees or grasses, or by building dams to hold back water and soil. One of the best ways to prevent erosion is to keep land covered with closely growing plants, such as grass and trees.

Water Conservation. All forms of life must have water to survive. In addition, people have developed many uses for water. For example, they use it to grow crops and to produce electric power. They also use it for manufacturing, recreation, and transportation. In homes, people use water for bathing, cleaning, and cooking and to remove wastes.

There is as much water on the earth today as there ever was—or ever will be. But only about 3 per cent of the water on earth is *fresh* (unsalty). The rest cannot be used for drinking, farming, or manufacturing unless the salt is removed. Yet the demand for clean, fresh water increases continually. The supply of fresh water must be managed carefully to meet this demand.

Nature conserves water by means of a natural cycle (see WATER [Nature's Water Cycle]). Grass, trees, and other plants play an important part in the water cycle by absorbing rain water and holding it in the ground. If plants did not cover the land, most rain water would run off as soon as it falls. Such rapid run-off removes valuable soil, causes floods, and leaves little water for use during dry seasons.

People often upset the natural cycle of water to plant crops or to build factories and homes. These actions may destroy natural plant cover and drain ponds and swamps. People also deepen and straighten streams to make navigation easier. Such changes reduce the natural storage of water in the ground and increase the amount of run-off

People can hold water on the land by protecting plant life and by planting in areas that have no natural cover. They can also build dams to store water during wet periods for use in dry periods. Dams help prevent floods by controlling the flow of water. They also produce electric power and supply water for irrigation and for use in homes and industry. However, not all streams should be dammed. Some streams have too much *silt* (mud). If dams were built on these streams, the areas behind the dams would soon fill up with silt and become useless for storing water.

Water pollution ranks as one of man's most serious conservation problems. Many cities and towns allow untreated sewage to enter lakes and streams. Paper mills, chemical factories, metal-processing plants, and other industrial works often dump waste water into water supplies. Government and industry are working to stop such dumping and find ways to *recycle* (reuse) waste products. In addition, scientists are seeking improved methods to purify polluted water. See WATER POLLUTION.

Forest Conservation is closely related to water and soil conservation. Forests slow the run-off of rain and check erosion. This helps keep loose soil from clogging rivers and streams. Trees planted along the edges of fields can check the force of the wind and help prevent soil erosion. Forests provide homes for wildlife and offer opportunities for recreation. Well-managed forests supply wood products of various kinds, and provide jobs for workers in the forest-products industry. See FOREST AND FOREST PRODUCTS (Forestry and Conservation); TREE (Trees in Conservation).

In many regions, people have destroyed forests by cutting down trees without planting new ones. People also have caused many destructive forest fires by carelessly tossing away lighted matches or cigarettes. Fires have damaged or killed trees and burned the humus out of the soil. In addition, insects and plant diseases have damaged many forests.

Well-protected forests can serve man indefinitely. Many lumbermen in the United States, Canada, and other countries have learned the importance of harvesting trees in such a way that the land will continue to provide lumber. They replant where necessary, and do not cut down young trees or seed trees.

CONSERVATION TERMS

Erosion is the removal of soil by water or wind.

Habitat is the place where an animal or plant lives and finds its requirements for life.

Humus, a substance found in soil, consists of the partially decayed remains of animals and plants. Humus helps hold water in soil.

Irrigation is the artificial watering of plants.

Land Drainage is the artificial removal of water from land by means of ditches or pipes.

Plant Cover is the combination of all plant life—mosses, grasses, shrubs, trees—on any soil surface.

Run-Off is the flow of water over the ground surface into streams and other bodies of water.

Strip Cropping means raising different crops in alternating strips to control erosion.

Sustained Yield is the continuing growth and production of animals or plants as a result of proper care and control.

Terracing means plowing or shifting the soil on hillsides so it lies in horizontal plots that check the flow of water and resist erosion.

Urban Renewal is the repair or rebuilding of city neighborhoods.

Vegetated Waterway is a field drainage channel that is planted with grass to prevent erosion.

Watershed is the land from which water drains into a river. *Watershed management* means the control of the plant cover and soil to achieve a regular flow of clear water into the river.

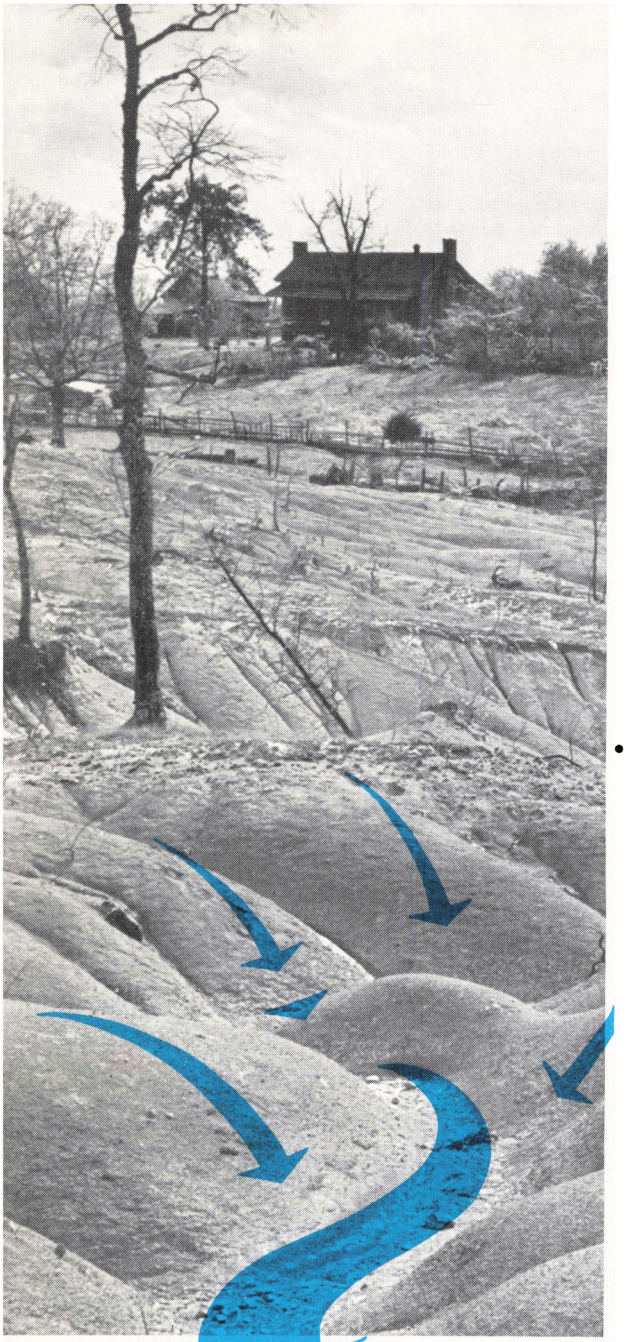
The Forest Service of the United States Department of Agriculture manages the national forests and cooperates with the states and private landowners to conserve forests. Their efforts include fire prevention and fire fighting, control of disease and insects, technical services to timber owners and loggers, and forestry research.

Wildlife Conservation. Wild animals play an important part in the balance of nature, and furnish us with many important products. Birds and other small animals help control insects. Wild animals provide fur, food, and recreation. They also make our surroundings more interesting.

Uncontrolled hunting has destroyed much wildlife. People have also harmed animals by destroying their *habitats*, the places where animals live and find food. Many animals, such as the passenger pigeon, have disappeared completely (see PASSENGER PIGEON). Others, including the whooping crane, the blue whale, and the American alligator, are in danger of dying out.

Sometimes it is necessary to keep animals from becoming too plentiful. For example, rabbits and such rodents as ground squirrels and mice may cause great damage to crops if they are too abundant. Deer may eat

.....soil conservation



T.V.A.

Erosion Takes Its Toll of unprotected farmland. Rain water running down the slopes of this farm can wash away 60 truckloads of topsoil a year and carve deep gullies.

Soil Conservation Service, USDA

Contour Plowing conserves water and prevents erosion. The deep furrows run across the slope of the land. Rain water collects in the troughs and soaks into the ground instead of running off.

United Press Int.

Wind Erosion caused the "Dust Bowls" of the Great Plains. In times of drought, wind picks up the dry or sandy soil and carries it across the land in violent dust storms.

so much vegetation that the herd will starve in winter because no food is left. *Predators* (animals that eat other animals), such as foxes and coyotes, help hold down the population of their prey.

All animals are of interest to scientists and lovers of the outdoors, and care must be taken to prevent any species from becoming extinct. After a species dies out, it is gone forever.

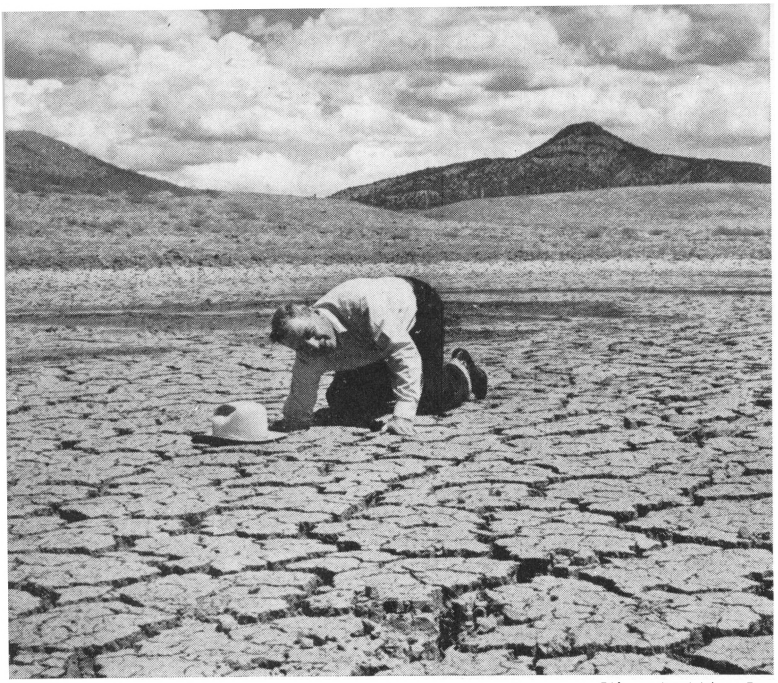
We can best protect game and fish by taking care of the places where they live. This enables wildlife to live well, raise their young ones, and hide from their enemies. Partridges, for example, need food patches, brushy undergrowth for shelter, and shrubs and trees in which to hide from hawks. Young trout need clean, cool water to thrive and grow. Squirrels need trees in which to build their nests. Migrating birds need feeding and resting places on their journeys. The federal and state governments have established hundreds of wildlife refuges throughout the United States to give animals a safe place in which to live.

Fish and game laws keep fishermen and hunters from killing too many animals. In the late 1800's, for example, only about 550 bison (American buffalo) remained of the great herds that once roamed the United States. Hunters had killed the rest. Game laws and other protective measures saved these mighty animals. About 10,000 bison now live in various parts of the Western United States. See WILDLIFE CONSERVATION.

Conservation of Grazing Lands. A large part of the Western United States consists of lands on which only grass and shrubs grow. These *dry grazing lands* lack enough rain to grow trees. They often have years of almost no rain at all. More than half the United States is grazing land, most of it in the dry areas west of the

Strip Cropping helps prevent wind erosion. On this Montana farm, rows of wheat alternate with rows of *fallow*, or idle, land. The wheat helps break the force of the wind, preventing it from blowing the fallow soil. Wheat farmers often let half their land lie fallow each year in order to give it a chance to soak up rain.

International Harvester



Life, © 1951 Time, Inc.

Too Little Water. Years of drought turned this Arizona water hole into a cracked, sun-baked mud flat. Man cannot prevent drought. But careful use and planning can help provide a supply of precious water for times of need.

Too Much Water. Heavy rains flooded much of this city in New York. Floods destroy lives and property and carry away valuable soil. Dams, reservoirs, and other flood-control projects play an important part in water conservation.

Mississippi River. Ranchers use this land to graze sheep and cattle. Livestock also graze on woodlands, cleared lands, and planted fields in the East, the South, and parts of the West.

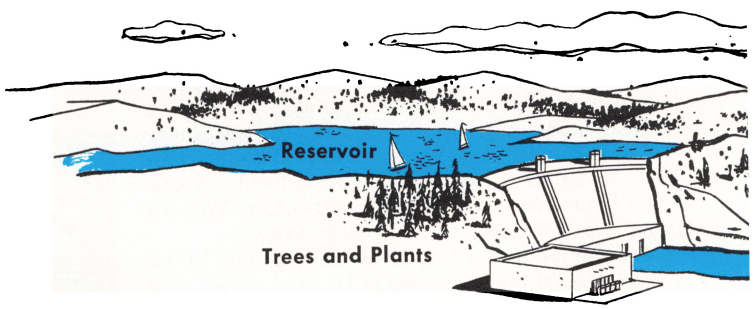
Americans have mistreated much of their grazing lands. The main damage came from years of overgrazing. Livestock have destroyed much of the original plant cover in some areas. Fires have also injured the grass and soil. Mesquite brush, which has low value for grazing, has sprung up in the grazing land in some regions of the West. In other areas, grazing has speeded up the normal erosion. Much wildlife has been destroyed or greatly reduced. The loss of plant cover has also reduced the value of the land as a *watershed*, or drainage area.

Careful grazing can restore and preserve much of the eastern grazing lands. But the dry West presents a more difficult problem. It may take 20 to 50 years for grass to return to an area where it has been destroyed. The federal government owns about a third of the dry western grasslands and has taken the lead in protecting these areas. The federal Bureau of Land Management limits the number of livestock that ranchers can graze on the public lands (see PUBLIC LANDS). It has also taken steps to replant grasslands, control erosion, and provide watering places for livestock.

Mineral Conservation. Without minerals, we would have few conveniences of modern life. Minerals provide steel for automobiles, copper for telephone wires, and aluminum for airplanes. Coal, gas, and petroleum are burned for power and heat. Uranium and other radioactive elements produce atomic power. It took nature millions of years to make minerals. But a bed of coal that took a million years to form can be mined and burned by man in a few years. See MINERAL.

We can conserve minerals by mining them carefully, reusing them when possible, and finding substitutes for those that are scarce. Scientists have discovered methods of refining petroleum so that little is wasted or unused. They also have found efficient ways to extract metals from ores so that the loss is small. Plastics provide an important substitute for minerals. The reuse of scrap metals also helps conserve minerals.

Conservation for Recreation has become more important than ever before. Industrial progress, such as



One Way to Conserve Water is shown in this drawing. Trees and plants hold water on the land and prevent floods. The reservoir stores water and serves as a recreational area. The dam controls the river's flow and puts it to work turning generators in the powerhouse. An irrigation canal carries water to farmland. The waterworks pumps water from the river, purifies it, and sends it to city homes. A sewage treatment plant makes waste harmless before returning the water to the river. This insures safe water for cities downstream.

Wide World

automation, gives us more spare time to enjoy the outdoors. Modern transportation makes it possible to reach forests, lakes, mountains, and beaches quickly and easily.

But the number of recreational areas has decreased as the need has grown. Private owners have closed many scenic spots. Other areas have been spoiled by misuse or neglect. Expanding cities have taken over beautiful countryside. As a result, our remaining recreational areas have become more and more valuable and should be preserved for the enjoyment of all.

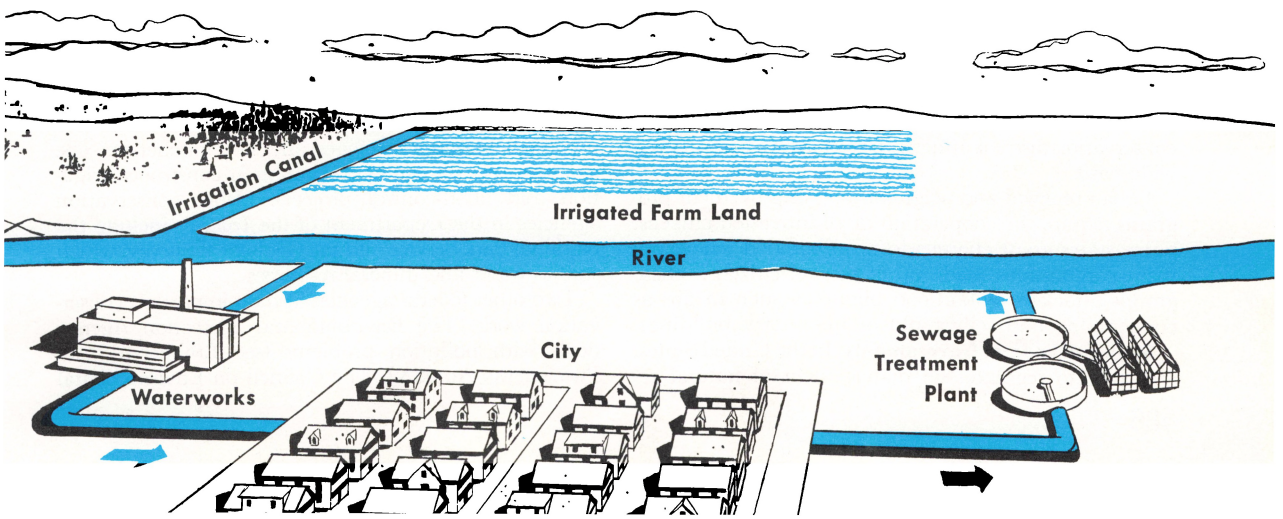
Nearly all natural resources have recreational value. For example, a river can provide a home for fish, power for homes and industry, and water for drinking. It can also supply a place for swimming, fishing, boating, and other recreation. Western grazing lands serve as good hunting areas. Reservoirs created mainly to control floods and maintain waterways can also be used for water sports. For example, Lake Mead behind Hoover Dam is a popular recreation area.

Almost every city or town has at least one park. Most state governments try to establish state parks within about 30 miles (48 kilometers) of every citizen. The National Park Service operates 38 national parks that cover more than 15 million acres (6 million hectares). National forests and monuments are also important recreational areas. See NATIONAL FOREST; NATIONAL PARK SYSTEM.

Conservation in Urban Areas. Most people in industrial nations live in cities and towns. If an urban environment is poorly planned and not well cared for, it can become an uninteresting, unhealthy place.

Automobiles, factories, and power plants release *pollutants* (impurities) into the air. These pollutants make breathing unpleasant and even harmful. Sewage and industrial wastes pollute lakes, rivers, and oceans near cities. In some places, the water has become unsafe for fishing and swimming. Junk and litter collect in city streets and empty lots, and some urban areas have no more places in which to dump garbage.

Cities also face overcrowding, and many neighborhoods have poor housing. Public transportation does not meet the people's needs, and city streets often become jammed with traffic. Many cities lack parks and playgrounds for outdoor recreation.



F.S.A.

Careless Cutting produces ruin and waste. Wise lumbermen never cut down an entire forest. They leave trees to scatter seeds and reforest the land. Cutover land loses its value as a watershed. Trees hold water on the land. On land such as this, water runs off quickly, causing floods and washing away the soil.

U.S. Forest Service

Raging Forest Fires destroy valuable timber and threaten lives and property. They also ruin the fertility of the soil and destroy the forest as a home for wildlife. Once they start, forest fires are hard to fight. But man can prevent most forest fires with care and planning.

A number of city governments have taken steps to save and improve urban areas. Local governments have passed laws to control air and water pollution, and scientists are working on methods to reduce it. Cities are also seeking better ways of removing and recycling wastes. Many have begun urban renewal projects to provide new housing and improve run-down areas. In addition, cities are working to improve their public transportation and to provide open spaces for recreation.

How Conservation Is Achieved

Individuals can do much to promote conservation. But people have to work together in order to care for our natural resources properly. They can work with their neighbors in community conservation projects, or take part in projects carried on by state and federal governments. Nations join to fight waste and promote conservation on an international level. Special organizations work for conservation and help educate citizens in preventing waste and destruction of natural resources. Schools also play an important part in conservation by teaching young people its importance.

Community Cooperation. Some of the responsibility for conservation rests on local communities—the county, city, town, and village. Citizens often band together in *conservation districts* for various purposes. These districts are sponsored by state and federal governments. Farmers join *soil-conservation districts* to get technical assistance and to work out efficient farm-management plans. In the United States, more than 2,700 soil-conservation districts attack soil erosion on a community-wide basis.

Urban renewal and neighborhood improvement programs require the cooperation of all interested citizens. Some states grant charters to neighborhood redevelopment corporations made up of private citizens. These groups attack neighborhood blight by such means as condemning and selling old or unsanitary buildings.

State and Federal Governments. In the United States, the right to regulate the management of natural resources belongs, by law, to the states. For example, a state can pass laws to reduce waste of natural gas and to control the amount of petroleum taken from the ground. State laws govern conservation districts. Many states own forests that they manage according to planned conservation practices.

Each state government has departments that protect and manage wildlife resources, and regulate hunting and fishing. Many states have agencies devoted to forest and water conservation. These departments not only do much conservation work, but also conduct active programs of conservation education.

The federal government and the states share in water-resource research, in the cost of forest-fire control, and in tree planting. The federal government also joins with local communities to share the costs of reducing stream pollution and in the removal of slum areas in cities. The U.S. Extension Service provides trained men and women to help farmers plan conservation programs. The Extension Service centers its work at state land-grant universities and colleges. Agricultural experiment stations at these schools encourage correct land-use practices.

In addition to working with state and local governments, the federal government has responsibility for a vast range of conservation activities. The Forest Service of the U.S. Department of Agriculture manages the national forests. The department's Soil Conservation Service works with soil-conservation districts. The Fish and Wildlife Service of the Department of the Interior works with the states on wildlife conservation. It also maintains waterfowl refuges and fish hatcheries. The department's Bureau of Reclamation constructs irrigation and flood-control projects. Other conservation agencies in the Department of the Interior include the National Park Service and the Geological Survey, which studies water and mineral resources.

Two other federal agencies also do important conservation work. The Environmental Protection Agency deals with pollution problems (see ENVIRONMENTAL PROTECTION AGENCY). The Council on Environmental

Quality watches over the nation's conservation activities and helps develop federal conservation policies.

International Cooperation. Nations often work together to solve mutual conservation problems. The United States and Canada cooperate to conserve the halibut fisheries off the coast of British Columbia. Treaties between the two countries limit the amount of fish that can be taken from these waters. A joint commission studies the fishery problems and establishes and enforces regulations. A treaty between the United States and Canada protects waterfowl that migrate between the two countries.

Canada, Japan, Russia, and the United States have a treaty that controls the hunting of fur seals in the northern Pacific Ocean. Many nations have joined in an international agreement to conserve whales. The waters of the Rio Grande are the subject of an agreement between the United States and Mexico.

The UN has a continuous program of studies and activities in the field of international resources. The World Health Organization; the Food and Agriculture Organization; and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) deal with special conservation problems on a world scale. In June, 1972, representatives of more than 110 nations met in Stockholm, Sweden, for the UN Conference on the Human Environment. As a result of this conference, the governments of many nations pledged to give greater attention to protecting and restoring the environment. In addition, several wealthy nations promised to help developing countries solve their conservation problems.

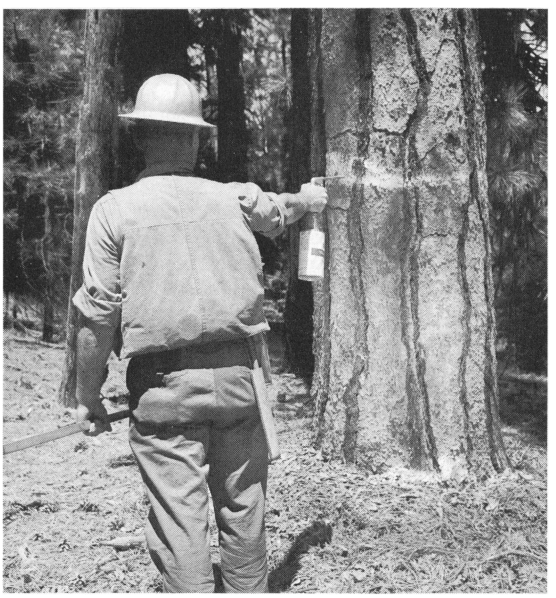
Special Organizations. Many organizations work for conservation. Such groups in the United States include the American Forestry Association, Friends of the Earth, the Izaak Walton League, the National Audubon Society, the National Wildlife Federation, the Sierra Club, and the Wilderness Society. These organizations promote all types of conservation. Some groups do special conservation work. For example, the Conservation Foundation and Resources for the Future conduct conservation research, and the Nature Conservancy buys land for conservation.

Many organizations include conservation work among their activities. Among these groups are the Garden Club of America and the League of Women Voters. Such youth organizations as the Boy Scouts, the Camp Fire Girls, 4-H, the Girl Scouts, and the Future Farmers of America also do conservation work.

Several international organizations promote conservation throughout the world. Such groups as the World Wildlife Fund and the International Union for Conservation of Nature and Natural Resources work with national governments and with the United Nations.

Conservation Education. Conservation is an important school subject in the United States. Many other school subjects also contribute to an understanding of the need for and the processes involved in conserving natural resources. Classroom projects and field trips are two special ways that students learn about conservation.

Classroom Projects help make conservation more meaningful. Students in chemistry and general-science classes sometimes test samples of soil from their yards and gardens. Classes may make plaster models that show how erosion occurs and can be prevented. Biology students make aquariums that illustrate the balance of nature between fish, water, and plants. Geography classes sometimes make maps that show the locations of forests and forest areas destroyed by fire. Art classes make picture exhibits to show the importance of various kinds

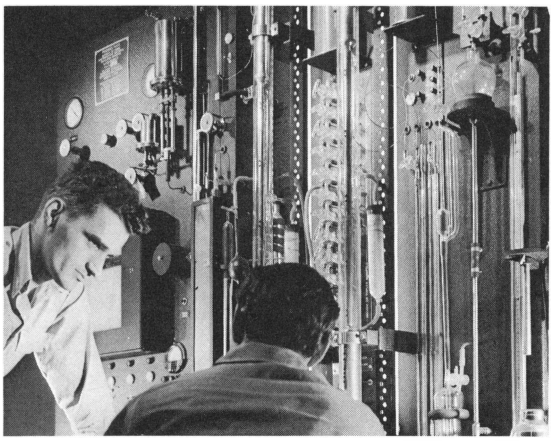


U.S. Dept. of Agriculture

Selective Cutting makes room for new growth. This forester uses a paint gun to mark a tree for cutting. Conservation-minded lumbermen do not cut young trees or trees that produce seeds.

American Forest Institute

Plowing a Fire Line around a forest helps protect it from fires. This open space prevents flames from leaping from tree to tree. Fire lines are an important means of fire protection.



Robert Yarnall Richie

The Battle Against Waste is often fought in the laboratory. These petroleum scientists use a miniature refinery to plan ways to get the most out of a barrel of oil. Research such as this can find means to make the best use of mineral resources.

of conservation. Students in most parts of the country plant trees on Arbor Day (see ARBOR DAY). In some schools, students work in school gardens that raise vegetables for their lunchrooms. Raising pets and collecting minerals are other examples of classroom projects related to conservation.

Field Trips serve as an effective and interesting way to learn about conservation. Some states operate camps as part of their regular school programs. In these camps, young people learn some of the problems involved in conservation of land and wildlife. Students may make trips to sewage-disposal plants. They learn how engineers remove impurities that would pollute the water supply. Students sometimes take trips to farms to see soil conservation at work. See NATURE STUDY.

Conservation in the United States

Early Efforts. When the first colonists settled in America, they found a land of great natural wealth. The pioneers had no idea that good farm land, forests, and wildlife would ever become scarce. Some of the early farmers, such as those of southeastern Pennsylvania, continued the careful farming methods they had learned in Europe. But most of the settlers moved on to unused land when their farms wore out.

Some leaders became concerned about what was happening to the natural resources. Thomas Jefferson favored contour plowing to hold soil in place. George Washington worried about soil erosion on his Mount Vernon estate. His workers dug mud from the shore of the Potomac River and used it to fill in eroded fields.

During the 1700's and 1800's, individuals and private organizations sometimes protested the waste of natural resources and promoted efforts to conserve them. The naturalist and writer Henry Thoreau wrote articles urging the establishment of wilderness areas where wild animals might live in safety. The bird paintings of John J. Audubon helped create a worldwide interest in birds. In 1864, the judge and geographer George Perkins Marsh wrote *The Earth as Modified by Human Action.* This book aroused wide interest in conservation problems.

In spite of the efforts of these and other men, the resources of the eastern United States were gradually reduced during the 1800's. Timber became scarce along the East Coast. Only the opening of the Western forest areas prevented a timber shortage in the United States. In the West, pioneers cut down or burned the forests, plowed up grasslands, and killed many kinds of wildlife. Wasteful hunting methods wiped out almost all the buffalo. Miners dug minerals in such a way that only part of the copper, iron, and coal was removed.

As wildlife declined, state governments passed fish and game laws. Steps were taken to conserve scenic resources. In 1872, the government established Yellowstone National Park, the first national park in the world. Also in that year, J. Sterling Morton, a Nebraska politician who later became U.S. Secretary of Agriculture, started the custom of Arbor Day. In 1891, Congress passed a law giving the President the right to set aside areas as forest reserves. In 1898, Gifford Pinchot, one of the outstanding leaders of the conservation movement, became head of the division of forestry in the Department of Agriculture. Under Pinchot's leadership, the division took an increasingly important part in forest conservation. It became the Forest Service in 1905.

National Policy. In spite of these early efforts, the conservation movement did not make much progress until President Theodore Roosevelt, with Pinchot's help, gave it his powerful support. Roosevelt added more land to the national forests than did all other presidents before and after. He also regulated grazing in national forests. In 1908, he called the first White House conference of governors to consider conservation problems. As an outgrowth of this conference, 27 states established conservation commissions within two years. Also in 1908, Roosevelt appointed the National Conservation Commission, headed by Pinchot. This commission included 49 prominent men of science, industry, and politics. The group made the first inventory of natural resources in the United States.

Delegates from the United States, Canada, Newfoundland, and Mexico met at the North American Conservation Conference in Washington, D.C., in 1909. This meeting helped publicize the need for conservation. The delegates approved a broad statement of conservation principles. The following year, the geologist and educator Charles R. Van Hise published the first textbook on conservation, *Conservation of Natural Resources in the United States.*

Congress passed the Weeks Law in 1911. This act made it possible to enlarge national forests by purchasing areas from which water drains into navigable streams. President Woodrow Wilson signed the bill that established the National Park Service in 1916. He also signed the first migratory bird treaty with Canada in 1916. The treaty went into effect in 1918.

Several men played an important part in helping to establish and promote a national conservation policy during and after this period. The naturalist John Muir wrote of the natural beauty of the West and the need to care for it. Muir helped establish Yosemite National Park. The cartoons of Jay N. "Ding" Darling fought for conservation of wildlife and other resources. Newspapers

United Press Int.

Wildlife Refuges protect birds and other animals. Ducks on their way south for the winter rest and feed safely at this waterfowl refuge located near Washington, D.C.

·····wildlife conservation

"Planting" Fish restocks lakes and ponds where fishing and pollution had reduced the supply. Wildlife conservation agencies raise fish in a hatchery and then put them in a body of water.

U.S. Dept. of Agriculture

throughout the country printed Darling's cartoons. Fairfield Osborn, Paul B. Sears, and other scientists also made important contributions to conservation through their books and as leaders of conservation groups.

The 1930's and 1940's saw an increase in conservation on the national level under President Franklin D. Roosevelt. During the depression of the 1930's, thousands of unemployed men and youths worked on federal conservation projects. From 1933 to 1942, the Civilian Conservation Corps (CCC) continuously employed between 175,000 and 500,000 young men in the protection and improvement of natural resources. CCC workers planted more than 2,000,000 acres (810,000 hectares) of forests and fought countless fires. See CIVILIAN CONSERVATION CORPS.

Congress established the Tennessee Valley Authority in 1933 to preserve and develop the resources of the area. That same year, the Department of the Interior set up a Soil Erosion Service. The service was transferred to the Department of Agriculture in 1935 as the Soil Conservation Service. The Taylor Grazing Act of 1934 ended the unregulated grazing of public grazing lands. From 1933 to 1943, the National Resources Board, later the National Resources Planning Board, made studies of the nation's resources and their best use. The Flood Control Act of 1936 established the first national policy on flood control.

By the time the United States entered World War II in 1941, the conservation movement included all efforts to preserve the country's natural resources. Rationing, scrap-metal drives, and other wartime activities helped drive home the message of conservation. They showed how a nation depends on its resources.

Recent Developments. The population of the United States has increased greatly since World War II ended in 1945. This population growth has created overcrowding and pollution. Cities and suburbs have grown and replaced former farmland or wild country. Business, industry, and transportation have also expanded, putting greater demands on natural resources.

The federal, state, county, and city governments have become increasingly active in trying to solve conservation problems. The federal government has taken a greater role in controlling pollution and setting aside land for national parks, recreation areas, and wildlife refuges. Citizen groups have forced federal action in many cases. In 1970, for example, the government stopped construction of a jet airport in the Florida Everglades. The government took this action after conservation groups protested that the airport would endanger wildlife.

During the 1960's and 1970's, the government set up many agencies and programs to protect the environment. The National Environmental Policy Act, which became law in 1970, established the right of every citizen to a healthful environment. The act enables a citizen to force the government to protect natural resources. It requires a federal agency to study how various projects, such as the construction of a highway, could affect the environment. The agency involved in the project must make these studies public, and a citizen can challenge any project in the courts. The courts also take an active role in conservation. In many cases, a

Bernard E. Ury Associates, Inc.

Urban Renewal Projects attempt to provide better housing and a healthier environment for city residents. These townhouses in Chicago form part of a new community that replaced a slum. The homes surround an open play area.

court has stopped the government or private industry from harming the environment.

Conservation in Other Countries

Canada faces many conservation problems similar to those of the United States. The country has thick forests, rich minerals, and plentiful water. But the early settlers wasted many of Canada's natural resources. They cut down trees in the forest region that stretched from the Atlantic to the Pacific coasts. Fires also caused serious damage to forests. The loss of forest cover has injured wildlife and led to erosion and the silting up of streams. Hunters have also killed much wildlife. In southern Canada, some farmland has become eroded. Farms in the western part of the country require irrigation. Cattle have destroyed much land by overgrazing. Canada's urban areas face problems of decay and pollution.

Canada has developed many programs to solve its environmental problems. The government works with private industry to conserve natural resources. It directs a program to save forests by planting new trees and maintaining a system of national parks. To protect wildlife, Parliament has passed laws that limit fishing and hunting. Parliament also has set aside land for wildlife refuges.

A water development program began in Canada during the 1930's. This program set up a system of dams and reservoirs that provide water for irrigation and for use in homes. In the 1960's, the government began a program to improve land use in farm areas. In 1970, Parliament passed a law to protect Canada's Arctic region from destruction by the oil industry developing there. The government also provides aid to urban areas for the construction and repair of housing.

Latin America. Europeans began to colonize Latin America during the late 1400's. Their arrival brought disastrous changes to the land. The settlers' cattle and horses overgrazed grasslands, contributing to soil erosion and the silting up of rivers. People cut down forests near settlements and tried to farm steep slopes that had poor soil. But much of the land remained unharmed for many years because of the small population. In addition, the deserts, mountains, and tropical forests discouraged settlement in many areas.

After World War II, the population of Latin-American countries began to increase rapidly. People moved into many previously unsettled areas. In Brazil, during the early 1970's, people began to settle the rain forest along the Amazon River. Few persons had entered this area before.

Today, conservation is widespread in Latin America. Brazil, Chile, Costa Rica, Ecuador, Mexico, Peru, and Venezuela have irrigation projects. Brazil has established many large national parks and has passed laws to protect wildlife. Many other nations, including Argentina, Colombia, Mexico, Peru, and Venezuela, have developed national parks and have acted to protect wildlife.

All Latin-American countries face problems of pollution, poor soil, and urban slums. Population problems in urban areas have led to increased demands for land and other resources. Latin-American governments face the task of trying to meet these demands without destroying the environment.

Europe, north of the Alps and Pyrenees mountain ranges, has not suffered serious resource damage. But it has lost much of its animal and plant life. Most countries of central and northern Europe have large populations and use most of their land to grow crops and graze animals. But these nations have a low rate of population growth, and their people do much to protect nature.

Norway and Sweden have had forest conservation programs since the 1860's. Belgium and Denmark use fertilizer to make rich farmland from poor, sandy soil. Belgium and The Netherlands build dikes and drain portions of the sea from the land. They have created some of the richest farmland in the world. Switzerland controls floods in mountain streams with careful forest management.

Southern Europe has a long history of land misuse. As long as 500 years ago, goats and sheep destroyed plants and ruined soil by overgrazing in much of

Greece, Italy, and Spain. Heavy rains washed away soil and created swamps in valleys. The people of southern Europe have begun to repair the damage from the past and to protect the resources that remain. For example, most southern European countries have programs of reforestation of their hills and mountains.

Russia has many conservation problems similar to those of Canada and the United States. Fires and logging have damaged Russia's northern forests, and water and wind have eroded farmland. Russia has started a program of conservation and resource development.

For centuries, the upper classes throughout Europe preserved wild animals and their habitats in order to have good hunting. But industrialization, population growth, and wars have harmed much European wildlife. Many countries have set up nature reserves and parks to protect wild animals. Finland, France, Great Britain, Norway, Poland, Russia, Sweden, and Yugoslavia have some of the best reserves.

Throughout Europe, pollution has become a major problem. Air pollution from automobiles and factories affects most regions. The Danube, Rhine, Volga, and other rivers have dangerous levels of pollution. Pollution of the Baltic, Mediterranean, and North seas has become so severe that several countries have begun to work together to control it.

Africa. In northern Africa, the people have destroyed forests and wildlife, and their domestic animals have worn out the dry grazing lands. Lack of care has brought soil erosion and dust storms. It also has caused the Sahara to spread. The nations of northern Africa have done little to repair this damage, though some have developed irrigation systems. Egypt, for example, has built dams and irrigation canals to control and use the waters of the Nile River. Several countries, including Chad, Senegal, and Sudan, have established nature reserves.

Serious conservation problems did not develop south of the Sahara until the European colonists arrived in that part of the continent in the late 1800's. Population growth led to the destruction of natural resources. Uncontrolled hunting and the construction of roads and towns destroyed much wildlife.

Some African countries have recognized the need for conservation. For example, South Africa set aside land for wild animals as early as the 1890's. Many other nations, including Kenya, Tanzania, and Uganda, have set up national parks and game reserves.

Since the end of World War II, African nations have given increased attention to all forms of conservation. The newly independent countries of Africa have tried to protect the land and its resources and also solve problems of population growth and poverty. With help from other countries, these developing nations may be able to avoid the loss of their natural resources.

Asia faces some of the world's most difficult conservation problems. Overgrazing, poor irrigation, the burning and cutting of forests, and the destruction of wildlife have seriously damaged the land. Asia also has the world's worst population problem. More than half the people of the world live in Asia, and the continent's population continues to increase rapidly.

The worst conservation problems occur in the dry areas of southwestern Asia. There, overgrazing and attempts to farm poor soil have created deserts. But in some countries, such as Israel, irrigation has turned deserts into rich farmland.

India has one of the world's most serious population problems. Many of its people live in poverty and face food shortages, overcrowding, and water pollution. Since the mid-1960's, India has done much to achieve higher food production by means of improved varieties of grain. Large-scale irrigation projects supply water for millions of acres of land. India has also tried to slow its population growth in order to ease overcrowding and pollution. The government has set up parks to protect wildlife.

The wet, forested areas of Southeast Asia face severe conservation problems. Much of that region's timber has been cut, but no effort has been made to plant new trees. Wars have also caused serious damage, especially to the rich farmland of the Mekong Delta in South Vietnam.

In China, most of the forests have disappeared, and heavy rains and wind have removed much soil from the hills. China's soil could have become worn out from centuries of farming, but careful methods of planting and fertilizing have preserved it. Many Chinese farmers raise crops on terraces carved out of the hillsides. Terraces help prevent soil erosion and allow farmers to cultivate steep slopes.

Japan has few natural resources, but it works to protect them. In the 1930's, Japan established many national parks. The Japanese have always taken good care of their farmland and forests. After World War II, Japan experienced a great increase in population and became one of the world's chief industrial nations. This growth created severe problems, including air and water pollution, overcrowding, and poor transportation. By the 1960's, Japan had halted its population increase and had acted to protect the environment.

Careers in Conservation

Conservation offers many kinds of careers for persons interested in the problem of preserving natural resources. Thousands of experts are needed to devote their lives to conservation problems. An interest in the outdoors leads some persons to careers in forestry, soil conservation, wildlife management, and similar occupations. People who prefer laboratory work may enjoy such jobs as water purification and biological studies. Other careers await in conservation education, and in city and regional planning. Membership in such organizations as the Boy Scouts, Girl Scouts, 4-H, and the Future Farmers of America can help young people choose the conservation careers that will give them the greatest satisfaction.

Forestry offers a fine opportunity for a conservation career. In the United States, membership in this rapidly growing profession increased from only 10 persons in 1898 to about 30,000 in the early 1970's. Foresters protect woodlands from fire, insects, and disease. They also direct the care and use of forest land so that it will continue to produce good crops of trees. In addition, foresters safeguard the wildlife, water, and soil of the forest lands. They supervise grazing in forest areas. Foresters

work for the United States Forest Service, state forest services, and private industry.

An applicant for a forest-ranger job should have a college degree in forestry. More than 50 universities and colleges offer forestry degrees. A few schools also offer graduate forestry degrees for persons interested in research at forest experimental stations. Students of forestry study such subjects as chemistry, biology, botany, ecology, lumbering, and *dendrology* (the history and identification of trees).

Soil Science attracts young persons who enjoy active, outdoor lives. Soil conservationists supply farmers and ranchers with information on soil and water. They are employed by the Soil Conservation Service and other agencies of the U.S. Department of Agriculture, and also by state agricultural experiment stations. They are also employed by many farm cooperatives and private industries.

A soil scientist should have a college degree with a major in soils or in closely related subjects that concern land use. Students of soil science study such subjects as plant pathology, plant physiology, and genetics.

Wildlife Management jobs range from laboratory studies of microscopic plants and animals to policing fields and streams. The Fish and Wildlife Service, the Forest Service, the National Park Service, and other agencies employ experts in wildlife management.

Good fishermen and woodsmen may find jobs in wildlife conservation after finishing high school. But the best jobs require a college education. About 70 colleges and universities in the United States provide training in wildlife management. Persons with degrees in ornithology, entomology, zoology, and biology also find jobs in this field.

Civil Engineering plays an important part in many conservation programs. These include building roads for loggers or doing construction work connected with soil conservation. But civil engineers are especially concerned with the development, use, and conservation of water resources. They build dams, reservoirs, power plants, and water-supply systems. The Bureau of Reclamation and the Corps of Engineers of the United States Army are among the government agencies that employ engineers to work on such problems as flood control, irrigation, and water pollution. Civil engineers are employed by state and local governments and by private industry. They must have a college degree.

U.S. Forest Service

Overgrazed Land, shown at the right of the fence, soon becomes useless. If ranchers and government agencies act to protect grazing land, it remains rich in plant cover, as shown at the left.

Other Professions. Teachers play an important part in conservation by instructing students in good conservation practices. Colleges, universities, and some high schools give courses in conservation. These are usually taught by persons who majored in geography or biology. Sometimes majors in economics or political science teach this subject. Most state departments of conservation also employ persons who are specialists in conservation education. These positions require college training in conservation.

Persons with college degrees in regional planning or geography can find work with city and regional planning agencies. These groups study such problems as water supply, the establishment and care of parks, and urban renewal. Postgraduate work in city and regional planning is also desirable.

RAYMOND F. DASMANN

Related Articles in WORLD BOOK include:

CONSERVATION LEADERS

Darling, Ding
Miner, Jack
Muir, John
Osborn (Fairfield)
Pinchot, Gifford
Roosevelt, Theodore
Sears, Paul B.
Van Hise, Charles R.

SOIL AND WATER CONSERVATION

Cropping System
Drainage
Erosion
Flood
Ground Water
Irrigation
Reclamation of Land
Sewage
Soil
Soil Bank
Waste Disposal
Water
Water Pollution

FOREST AND WILDLIFE CONSERVATION

Animal (How Man Protects Animals)
Arbor Day
Beaver
Bird (How We Protect Birds)
Fishing (Fish Conservation)
Fishing Industry (Conservation)
Forest and Forest Products
Fur (Fur Conservation)
Game
Tree Farming
Wildlife Conservation

CONSERVATION IN URBAN AREAS

Air Pollution
City (City Problems)
City Planning
Housing
Model Cities
Park
Transportation (Problems of Public Transportation; Government and Transportation)
Urban Renewal

CONSERVATION AND GOVERNMENT

Agriculture, Department of
Central Valley Project
Environmental Protection Agency
Fish and Wildlife Service
Interior, Department of the
Missouri River Basin Project
National Forest
National Park System
Prairie Farm Rehabilitation Act
Reclamation, Bureau of
Soil Conservation Service
Tennessee Valley Authority
UNESCO
World Health Organization

CONSERVATION ORGANIZATIONS

American Association for the Advancement of Science
American Forestry Association
Audubon Society, National
Boy Scouts
Camp Fire Girls
4-H
Future Farmers of America
Girl Scouts

Izaak Walton League of America
National Wildlife Federation
Sierra Club
Wild Flower Preservation Society of America

OTHER RELATED ARTICLES

Balance of Nature
Coal (Conservation)
Ecology
Environmental Pollution
Fire Prevention
Natural Resources
Petroleum (Petroleum Conservation)
Plant Quarantine

Outline

I. Kinds of Conservation
A. Soil Conservation
B. Water Conservation
C. Forest Conservation
D. Wildlife Conservation
E. Conservation of Grazing Lands
F. Mineral Conservation
G. Conservation for Recreation
H. Conservation in Urban Areas

II. How Conservation Is Achieved
A. Community Cooperation
B. State and Federal Governments
C. International Cooperation
D. Special Organizations
E. Conservation Education

III. Conservation in the United States

IV. Conservation in Other Countries
A. Canada
B. Latin America
C. Europe
D. Africa
E. Asia

V. Careers in Conservation

Questions

Why does a wise farmer not plant the same crop year after year?

How have the United States and Canada cooperated in conservation projects?

How long does it take to build 1 inch (2.5 centimeters) of topsoil?

In what way is soil conservation related to water conservation?

What are two vital reasons for protecting wildlife?

What region of the world faces the most difficult conservation problems?

What can be done to preserve mineral resources?

What are some youth organizations that help promote wise conservation practices?

What part did Theodore and Franklin Roosevelt play in conservation?

What are the eight chief kinds of conservation?

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CONSERVATION OF ENERGY. See ENERGY (The Conservation of Energy).

CONSERVATION OF MASS, LAW OF. See MASS.

CONSERVATION OF MATTER, LAW OF. See MATTER (Conservation of Matter).

CONSERVATION OF MOMENTUM. See MOMENTUM.

CONSERVATION OF PARITY. See PARITY.

CONSERVATISM is a political attitude or philosophy that places great emphasis on tradition. Conservatives rely on history as a guide to wisdom and goodness, and have great respect for historical institutions and traditional values and ideas. Therefore, they seek progress in line with proven values of the past. But the word *conservatism* is confusing because its meaning varies with time, place, and circumstance.

Principles of Conservatism. Conservatives take a limited view of what politics can achieve. They believe that the aim of politics, or government, is to help promote a good life for man in society. But most conservatives doubt that the good life can be brought about mainly by political means. They believe that all political problems are basically moral problems. They feel that legislation cannot significantly change human attitudes. Conservatives believe that man's potential for evil is as great as his potential for good. They doubt that evil will disappear with social reform or education.

Conservatives believe that rights are something a person earns, rather than something he is given. They emphasize the performance of duties as the price of rights. Conservatives believe in the desirability of maintaining social classes. They believe that all men have equal rights, but they deny that all are born with equal abilities or to equal wealth, advantages, and influence in society. They maintain that only a few are natural leaders, and that their leadership is essential to social order. For these reasons, conservatives consider political and economic leveling foolish and bound to fail.

Conservatives see a necessary link between the enjoyment of freedom and the institution of private property. They maintain that abolishing private property would destroy individual liberty. Therefore, many conservatives consider socialism and communism the greatest threats to modern society.

History. The name *Conservative* was first used around 1830. It was applied to the descendants of the old British Tory party, and the words *Tory* and *Conservative* are used interchangeably in Great Britain today. But conservative ideas were expressed as early as the 1700's in the writings and speeches of the British statesman Edmund Burke. Early U.S. conservatives included John Adams and Alexander Hamilton. Conservatism

arose partly as a reaction to the excesses of the French Revolution and the belief that human nature could become perfect through social change and political revolution. Conservatives argued that social change must be brought about within the framework of traditional ideas and institutions.

The word *conservative* as used in the United States today is often confusing. Many persons in the U.S. who call themselves conservatives advocate a return to the principles and theories of liberalism of the 1800's. They oppose almost all government regulation of the economy, and are economic liberals in the tradition of Adam Smith. Traditionally, however, conservatives have opposed both economic liberalism and socialism. They have tried to steer a middle course between the extremes of individualism and collective ownership, and they have generally favored a strong central government. A true conservative should also be distinguished from a *reactionary*. A reactionary wants to revolutionize existing society according to a model in past history. A true conservative is never revolutionary. He wants to preserve the best in the past and continue it into the future. JOHN H. HALLOWELL

See also LIBERALISM; RIGHT WING.

CONSERVATIVE PARTY is one of the two main political parties in Great Britain. The second is the Labour Party. Historically, the Conservative Party took the place of the Tory party that appeared in England during the late 1600's and flourished until the middle 1800's (see TORY). Benjamin Disraeli, a founder of the Conservative Party, worked for a new program for the Conservatives. He wanted the working class given the right to vote. He also sought to pass social legislation in favor of the workers and worked for stronger bonds between Great Britain and its empire.

Disraeli succeeded in "educating" his party. Conservatives passed the Reform Bill of 1867, which increased the number of working-class voters. After World War I, Conservatives helped reorganize the British Empire to achieve equality between Great Britain and the dominions. Winston Churchill, a Conservative, led a coalition government during World War II. After the war, the coalition ended, and the Labour Party was elected to power. The Conservative Party governed again from 1951 to 1964, and from 1970 to 1974. In 1975, the Conservatives elected Margaret Thatcher as party leader. She became the first woman ever chosen to head a major British political party. JAMES L. GODFREY

See also DISRAELI, BENJAMIN; PEEL, SIR ROBERT.

CONSERVATOR, in law. See RECEIVER.

CONSIGNEE AND CONSIGNOR. See BILL OF LADING.

CONSISTORY. See POPE (The Sacred College).

CONSOLATION OF PHILOSOPHY. See BOETHIUS, MANLIUS SEVERINUS.

CONSOLIDATED SCHOOL is the result of joining two or more school districts and combining their school populations. This term is generally used in rural or suburban areas. The need for more adequate school facilities in areas where the population is scattered led to the consolidation of independent school districts in many parts of the United States. Often, as many as six districts with inadequate schools have been combined to make two or three larger districts. Such consolidation insures a more varied curriculum, and better libraries and teaching staffs. R. FREEMAN BUTTS

CONSONANT, *KAHN suh nuhnt*, is a letter or sound which in speech requires hindering of the breath by the tongue, teeth, or lips. There are two kinds of sounds. The open sounds with free breath are called *vowels*. The closed sounds, called *consonants*, are made with the breath wholly or partly checked. *Stopped consonants* require complete stoppage of the breath. They are *b*, *d*, *g*, *k*, *p*, *t*. *Open consonants* require only partial stoppage of breath. They are *l*, *m*, *n*, *r*, *w*, *y*. The *spirants* are open consonants that require friction in the oral passages. They are *f*, *j*, *s*, *v*, *z*. *H* is an *aspirant*, or *breathed*, consonant. See also PRONUNCIATION; VOWEL. CLARENCE STRATTON

CONSORT. See PRINCE CONSORT; QUEEN.

CONSPIRACY, *kuhn SPIHR uh see*, is an agreement between two or more persons to do something that is against the law. It is not always necessary that the planned act be committed or that any person be defrauded or injured. The act of *conspiring* sometimes constitutes the crime. Each person involved is criminally responsible for everything that results, whether it was intended or not. Conspiracy is punishable by fines as high as $10,000, or imprisonment for as long as 14 years. If loss of human life results from a conspiracy, murder may be charged. See also COUP D'ÉTAT. FRED E. INBAU

CONSTABLE is a police officer in a rural community of the United States. He may arrest persons suspected of crime. But his main job is to carry out court orders. The word *constable* comes from the title of an official of the Eastern Roman Empire called the *comes stabuli*, or count of the stable. In France, the constable was once a member of the king's household, or a commander of the king's armies. In England, all policemen are called constables. H. F. ALDERFER

CONSTABLE, JOHN (1776-1837), is generally considered one of the greatest English landscape painters. He originated the kind of landscape painting that still looks most natural. Painters before him had painted landscapes in brown tones. When Constable used green for grass and leaves, his color seemed bright and vivid. He achieved this naturalness because he painted preparatory studies outdoors. Landscape painters who influenced him, such as the French artist Claude (Lorrain) and the Dutch masters, painted in studios.

Constable painted quiet views of the countryside near London and Suffolk. He painted summer, spring, and autumn scenes, but never winter scenes. Although his paintings lack imagination in subject and style, their naturalness in showing everyday scenes seemed romantic to people of his day. He painted in both oil and water color.

Constable became famous in France when his painting *The Hay-Wain* won a prize at the Paris Salon exhibition of 1824. French romantic painters, such as Eugène Delacroix, began to imitate some of Constable's methods. One of Constable's best-known landscapes, *Stoke-by-Nayland*, appears in the PAINTING article.

Constable was born in Suffolk, England, the son of a miller. As a boy, he drew the countryside around his father's mill, where he worked. He later said these placid scenes made him an artist. L. D. LONGMAN

CONSTANCE, COUNCIL OF. See POPE (The Troubles of the Papacy); SIGISMUND.

CONSTANCE, LAKE. See LAKE CONSTANCE.

CONSTANCE, PEACE OF. See FREDERICK (I) Holy Roman Emperor.

CONSTANCE MISSAL, a book of Masses for the German diocese of Constance, is one of the earliest books printed in Europe. Scholars believe that Johannes Gutenberg printed it about 1450, several years before he produced his famous 42-line Bible. The letters of the Missal are cruder than those of the Bible. The Pierpont Morgan Library in New York City owns the only copy of the book in the United States.

CONSTANŢA, *kawn STAHN tsah* (pop. 176,234; met. area 242,937), is the only Romanian seaport on the Black Sea. See ROMANIA (color map). The city has a modern harbor. A pipeline brings petroleum from the oil fields to Constanţa, which has large oil-storage tanks. Railroads connect Constanţa with the chief cities of the Danube Basin. Two Black Sea resorts, Mamaia and Eforie, are near Constanţa. ALVIN Z. RUBINSTEIN

CONSTANTINE was the name of one pope and of one antipope of the Roman Catholic Church.

Constantine I (?-715) became pope in 708. He was able to break the antipapal power of Felix, archbishop of Ravenna, and to maintain smooth relations with the Byzantine emperors. Constantine was born in Syria.

Constantine II (?-769), an antipope, was the brother of Toto, the duke of Nepi. At the death of Pope Paul I in 767, Toto, by force, had his brother elected pope, though Constantine was only a layman. Constantine was inept, and Toto dominated him. After 13 months, a legitimate election was held, and Stephen III was elected pope. Constantine was blinded and expelled from Rome. GUSTAVE WEIGEL and FULTON J. SHEEN

CONSTANTINE was the name of two Greek kings.

Constantine I (1868-1923) succeeded his father, George I, in 1913. During World War I, Constantine believed the Germans would win and he wanted Greece to remain neutral. Because of this, the Allies drove him into exile in 1917. He was recalled in 1920, after his son, King Alexander, died. In 1921, the Greek Army invaded Turkey. But the Greeks were defeated, and the king went into exile again in 1922 (see GREECE [History]). Constantine was born in Athens.

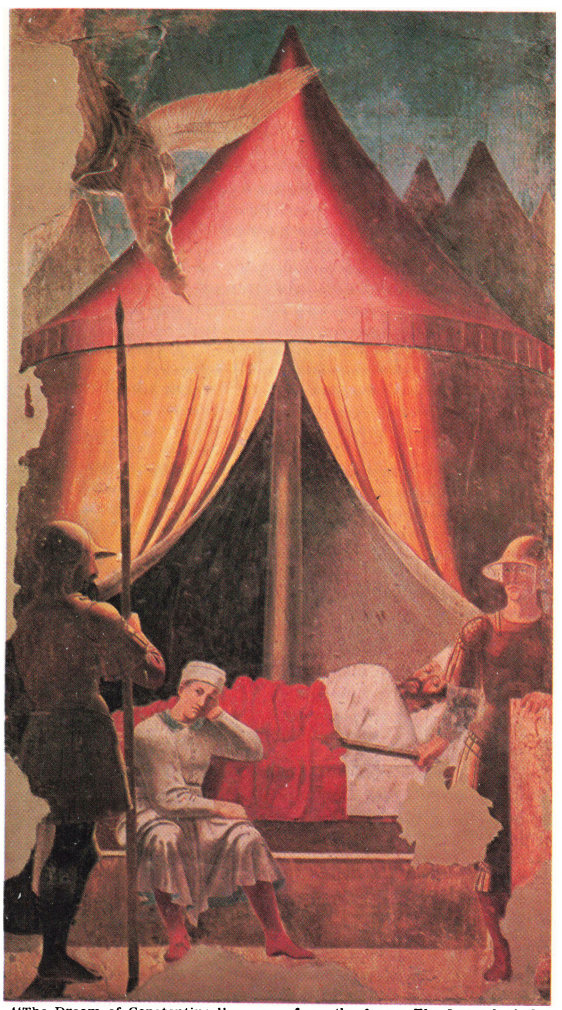
Constantine II (1940-) was king of Greece from 1964 to 1974. He became king after the death of his father, King Paul I. In December, 1967, Constantine unsuccessfully tried to overthrow the military junta that had been ruling Greece since April. The king and his family went into exile in Italy. In 1973, the junta abolished the monarchy and proclaimed Greece a republic. The junta's rule ended in 1974. In a special referendum held that year, Greek voters chose a republican form of government rather than a monarchy. Constantine was born in Psikhikón. R. V. BURKS

CONSTANTINE, Algeria (pop. 243,558; met. area 253,649), is a trading and mining center, and the capital of an Algerian political department. The original city was destroyed in A.D. 311, but Constantine the Great, whose name it bears, rebuilt it. It lies about 225 miles (362 kilometers) east of Algiers, the capital. It is connected by railroad with the port of Skikda. See also ALGERIA (map). KEITH G. MATHER

CONSTANTINE I, THE GREAT, *KAHN stuhn tyn,* was the first emperor of Rome to become a Christian. He was born about A.D. 275 and died in 337. During his reign, Christians gained freedom of worship, and the Christian church was recognized as a legal body. The Eastern Orthodox Churches regard Constantine as a saint. He rebuilt Byzantium (now Istanbul, Turkey), renamed it Constantinople, and made it his capital. The empire's strength began to shift from Rome to the eastern provinces. Some historians consider this the beginning of Byzantine history.

Constantine made many gifts to the Christian church, including huge estates which he gave to the church in Rome. He built the first great Christian cathedral, the Lateran Basilica in Rome. He built other famous churches in and near Rome; and in Antioch, Syria (now Antioch, Turkey); Constantinople; and Jerusalem.

Constantine's official name was Flavius Valerius Aurelius Constantinus. He was born in Naissa (now Niš, Yugoslavia). His father, Constantius, became emperor of the western provinces in 305. Constantius died and Constantine succeeded him in 306. The system of



"The Dream of Constantine," a scene from the fresco *The Legend of the True Cross* (1450's) by Piero della Francesca; Church of San Francesco, Arezzo, Italy (SCALA)

Constantine the Great told of having a vision while sleeping before an important battle. In the vision, Constantine was promised victory if he fought under the sign of the cross.

shared rule between two senior and two junior emperors, started by Emperor Diocletian, broke down completely. Seven claimants struggled for power. In 312, Constantine attacked Maxentius, his major rival in the west. Constantine later told how a vision before the battle had promised him victory if he fought under the sign of the cross. He ordered the Greek letters *chi* and *rho*, the first two letters of Christ's name, to be marked on his soldiers' shields. With these letters on their shields, Constantine's forces defeated Maxentius at the Milvian Bridge, which crosses the Tiber River. As a result of his vision, Constantine became a strong supporter of Christianity. The Arch of Constantine, built in Rome about 315, honors the victory over Maxentius.

In 313, Constantine arranged a partnership with Emperor Licinius, ruler of the eastern provinces. They met in Milan and issued a statement of policy called the *Edict of Milan* which gave freedom of worship and equal rights to all religious groups. Constantine recognized the Christian church as a legal body with rights to hold property, and returned property to Christians that had been seized. For more than 10 years, Constantine and Licinius ruled the empire jointly, each trying to gain supremacy. In 324, the rulers clashed and Constantine became sole ruler. Constantine made Constantinople his capital and the center of Roman government.

In 325, Constantine presided over the first great *ecumenical* (general) council of the Christian church. The council met in Nicaea, in what is now northwest Turkey, to deal with disputes among Christians, especially with the Arian heresy which placed Christ on a lower level than God. More than 300 bishops from all parts of the empire attended. The council condemned Arianism and drew up a statement of essential beliefs, called the *Nicene Creed* (see NICENE COUNCILS). Constantine died in 337, after being baptized a Christian on his deathbed. The empire was passed to his sons, Constantius, Constans, and Constantine II. RAMSAY MACMULLEN

See also BYZANTINE EMPIRE (Establishment).

CONSTANTINE PALAEOLOGUS. See BYZANTINE EMPIRE (Final Decline).

CONSTANTINOPLE. See ISTANBUL.

CONSTELLATION, *KAHN stuh LAY shuhn*, is a group of stars within a definite region of the sky. By knowing the positions of the constellations, it is possible to locate stars, planets, comets, and meteors. For thousands of years, man has used his knowledge of the constellations to guide himself from place to place during journeys over the surface of the earth. See STAR.

Each constellation has a definite time of the year when it *culminates* (reaches its highest point in the sky). At latitudes too far north or south of the equator, many constellations do not culminate high enough to be seen. The constellations appear to move westward as the earth rotates around the sun. For this reason, certain constellations can be seen only during one of the seasons of the year (see ASTRONOMY [Skies of the Seasons]).

In 1928, the International Astronomical Union fixed the boundaries of the 88 constellations in the sky. The Greeks recognized and named 48 constellations. Many of these same constellations were also recognized by the Arabs, the Egyptians, and the Babylonians. Since the 1700's, astronomers have named the 23 constellations that can be seen in the extreme Southern Hemisphere.

The names of the constellations are given in Latin, because Latin was once the language of learning. The names of the constellations used by the Greeks, Egyptians, and other peoples were translated into Latin. For convenience, the ancients named the constellations after a certain figure that its stars seemed to form in the sky. For example, the stars in Ursa Major, the Great Bear, seemed to form a bear. Today, the stars have changed positions somewhat and so they do not form clear outlines of the figures (see FIXED STAR). I. M. LEVITT

Related Articles in WORLD BOOK include:

Andromeda	Cassiopeia	Orion
Aquarius	Centaurus	Pegasus
Aries	Cepheus	Perseus
Auriga	Cygnus	Pisces
Big and Little Dippers	Draco	Pleiades
	Gemini	Sagittarius
Boötes	Hercules	Scorpius
Cancer	Leo	Southern Cross
Canis Major	Libra	Taurus
Capricornus	Lyra	Virgo

CONSTELLATION, a 36-gun frigate built in 1797, was the first United States Navy ship to capture a foreign warship. It captured the French frigate *L'Insurgente* on Feb. 9, 1799 during the undeclared war between France and the United States (1798-1800). Thomas Truxtun, who had supervised the construction of the *Constellation*, commanded the ship. His naval victories made him a national hero. In the early 1960's, the *Constellation* was restored in Baltimore, Md., where it was originally launched. It was designated a national historic landmark in 1964. MERRILL JENSEN

See also NAVY, U.S. (Undeclared War with France).

CONSTIPATION, *KAHN stuh PAY shuhn*, is a condition in which the bowel does not rid itself of waste materials in a normal manner. Constipated persons do not have regular bowel movements, and may have pain or tenderness over the colon. They also may suffer from headaches and backaches. Constipation may be caused by weakness of the bowel muscles, by a diet that does not supply enough bulky foods, or by the too frequent use of laxatives. Constipation may also accompany an illness that affects the tissues or nerves of the bowel.

When constipation results from a faulty diet, the patient should eat more green vegetables and fruits, and other foods that contain roughage. He also should drink ample quantities of water. Constipation may be a symptom of a serious disease. If it persists, or is accompanied by rectal bleeding, it should be investigated by a physician. E. CLINTON TEXTER, JR.

See also LAXATIVE.

CONSTITUTION is a statement outlining the agreed basic principles of formal organizations ranging from national governments to private clubs. It establishes the structure and purposes of the organization and the rights of its citizens or members. It also defines the powers of officers, how they are selected, and how long they can stay in office. Constitutions may also be called *articles of union* or *charters* (see CHARTER).

In Western political philosophy, the principles of constitutional government often have been based on a belief in a *higher law*—a body of universal principles of right and justice that is superior to detailed, everyday law. In modern democracies, a constitution's function is to put all men—including the rulers—under law.

Government constitutions may be *written* or *unwritten*. The United States has a written constitution. The British constitution is unwritten. It consists of tradition and custom concerning the powers of the monarch, Parliament, and the courts. Many parts of the British constitution were taken from written documents such as the Magna Carta. However, the constitution itself has never been written out in a single document. The British constitution can be modified by Parliament.

Most modern governments have constitutions based on a single document. In most democracies, the written constitution can be changed only by a special process, such as a special election. Such amending procedures reflect the belief that a constitution should deal with basic principles, and that special deliberation should be required to modify or replace these principles.

Many countries now have nondemocratic or military governments. In these governments, a constitution can be changed by *fiat* (a command or decree) of the ruling group. In such countries, a constitution is more a statement of purpose than a statement defining powers.

In actual operation, constitutions in most democratic countries are unwritten in the sense that the formal document is not the only vital element. Custom and how various governmental bodies interpret the constitution are equally important and sometimes dominant. Under power called *judicial review*, U.S. courts may declare acts of government *unconstitutional* if the acts are considered to conflict with the basic law of the constitution. Most countries have important *nonlegal* rules which do not come from the written constitution or court interpretation. If these nonlegal rules are an essential part of the system of government, they are part of the "constitution" in the broad sense of the term. For example, most aspects of the political party system and the rules for nominating the President in the United States are not specified in the written constitution or subject to court action. ROBERT G. DIXON, JR.

See also BRITISH NORTH AMERICA ACT; GREAT BRITAIN (Government); CONSTITUTION OF THE UNITED STATES; GOVERNMENT; BILL OF RIGHTS.

CONSTITUTION is a famous frigate of the United States Navy. Its popular name is *Old Ironsides*. The frigate was built at a Boston shipyard between 1794 and 1797. It was 204 feet (62 meters) long. The hull was made of oak from Massachusetts, Maine, and Georgia, and the masts of white pine. It could carry provisions for a crew of 475.

The *Constitution* was launched on Oct. 21, 1797. It was unharmed in battles with the Barbary powers in 1803 and 1804. In the War of 1812, it won a battle near Cape Race against the *Guerrière*, an English warship. During this battle, the ship earned its nickname. A sailor is said to have seen shot from the British guns bouncing off the *Constitution's* sturdy sides, and exclaimed that the ship had sides of iron. Isaac Hull, an American naval officer, commanded the frigate. After other battles, the *Constitution* was condemned in 1830 as unseaworthy and was ordered destroyed.

The poem "Old Ironsides," by Oliver Wendell Holmes, in which he wrote:

> Oh, better that her shattered hulk
> Should sink beneath the wave,

aroused public sentiment, and the vessel was rebuilt and restored to service in 1833. In 1855, it was put out of commission at Portsmouth Navy Yard and used as a training ship, but was again rebuilt in 1877. In 1897, a hundred years after its launching, the *Constitution* was finally drydocked and repaired, to be preserved as a memorial.

Calvin D. Campbell, Pictorial Parade

The *Constitution*, better known as *Old Ironsides*, one of the most famous vessels in the United States Navy, is docked on the Charles River near Boston.

Thirty years later, American children raised money to recondition the vessel for a tour of United States ports. In 1930 Congress appropriated $300,000 to complete the work. On July 31, 1931, *Old Ironsides* was commissioned into active service. After sailing 22,000 miles (35,400 kilometers), it returned to the Boston Naval Shipyard on May 7, 1934. The *Constitution*, still in commission, is docked on the Charles River near Boston. It is the oldest warship afloat in any of the world's navies. JOHN DONALD HICKS

CONSTITUTION DAY commemorates the signing of a constitution. In the United States, it falls on September 17. On that day, in 1787, delegates from 12 states signed the document that established a new form of government for the nation. Constitution Day is not a national holiday.

The signing of the Constitution of the United States climaxed a four-month session of debates in Independence Hall in Philadelphia. George Washington presided over the session that began on May 25. The convention proposed to ensure the rights that the Declaration of Independence had declared inalienable. The Constitution became one of the most important documents in history. It has served as a model for nearly every country that has adopted a constitutional form of government. These countries celebrate the adoption with their own Constitution Day. RAYMOND HOYT JAHN

CONSTITUTION OF THE UNITED STATES

CONSTITUTION OF THE UNITED STATES sets forth the nation's fundamental laws. It establishes the form of the national government and defines the rights and liberties of the American people. It also lists the aims of the government and the methods of achieving them.

The Constitution was written to organize a strong national government for the American states. Previously, the nation's leaders had established a national government under the Articles of Confederation (see ARTICLES OF CONFEDERATION). But the Articles granted independence to each state. They also lacked the authority to make the states work together to solve national problems.

After the states won independence in the Revolutionary War (1775-1783), they faced the problems of peacetime government. The states had to enforce law and order, collect taxes, pay a large public debt, and regulate trade among themselves. They also had to deal with Indian tribes and negotiate with other governments. Leading statesmen, such as George Washington and Alexander Hamilton, began to discuss the creation of a strong national government under a new constitution.

Hamilton helped bring about a national convention that met in Philadelphia in 1787 to revise the Articles of Confederation. But a majority of the delegates at the convention decided instead to write a new plan of government—the Constitution of the United States. The Constitution established not merely a league of states but a government that exercised its authority directly over all citizens. The Constitution also defined clearly the powers of the national government. In addition, it established protection for the rights of the states and of every individual.

The Supreme Law of the Land

The Constitution consists of a preamble, 7 articles, and 26 amendments. It sets up a *federal system* by dividing powers between the national and state governments. It also establishes a balanced national government by dividing authority among three independent branches —the executive, the legislative, and the judicial. The executive branch enforces the law, the legislative branch makes the law, and the judicial branch explains the law. The executive branch is usually represented by the President, the legislative branch by Congress, and the judicial branch by the Supreme Court.

Federal powers listed in the Constitution include the right to collect taxes, declare war, and regulate trade. In addition to these *delegated*, or *expressed*, *powers* (those listed in the Constitution), the national government has *implied powers* (those reasonably suggested by the Constitution). The implied powers enable the government to respond to the changing needs of the nation. For example, Congress had no delegated power to print paper money. But such a power is implied in the delegated powers of borrowing and coining money.

U.S. Capitol Historical Society (National Geographic Society)

The Signing of the Constitution took place on Sept. 17, 1787, at Independence Hall in Philadelphia. The American artist Howard Chandler Christy painted this picture in 1940. It hangs in the United States Capitol in Washington, D.C.

There are some powers that the Constitution does not give to the national government or forbid to the states. These *reserved powers* belong to the people or to the states. State powers include the right to legislate on divorce, marriage, and public schools. Powers reserved for the people include the right to own property and to be tried by a jury. In some cases, the national and state governments have *concurrent powers*—that is, both levels of government may act. The national government has supreme authority in case of a conflict.

The Supreme Court has the final authority to explain the Constitution. It can set aside any law—federal, state, or local—that conflicts with any part of the Constitution.

The Need for the Constitution

The government established by the Articles of Confederation was not strong enough to govern the new nation. For example, it lacked an executive branch and

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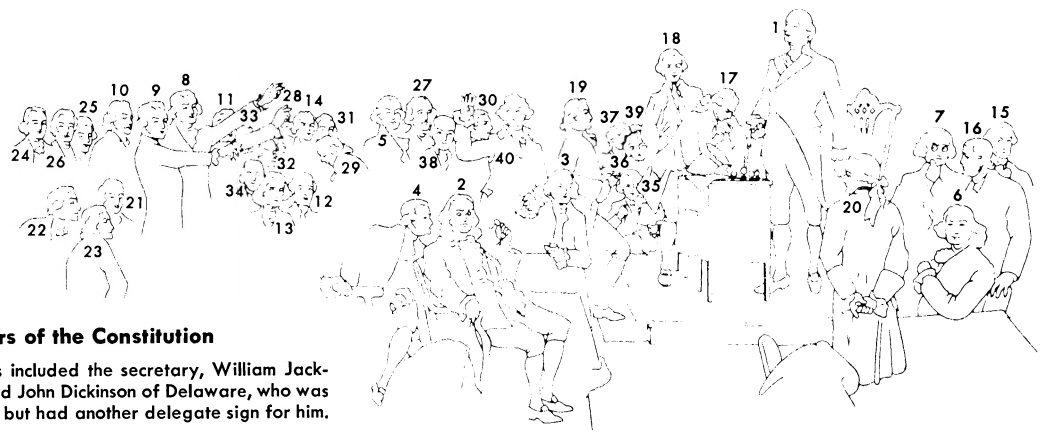

Signers of the Constitution

Signers included the secretary, William Jackson; and John Dickinson of Delaware, who was absent but had another delegate sign for him.

1. George Washington
2. Benjamin Franklin
3. James Madison, Jr.
4. Alexander Hamilton
5. Gouverneur Morris
6. Robert Morris
7. James Wilson
8. Charles C. Pinckney
9. Charles Pinckney
10. John Rutledge
11. Pierce Butler
12. Roger Sherman
13. William S. Johnson
14. James McHenry
15. George Read
16. Richard Bassett
17. Richard D. Spaight
18. William Blount
19. Hugh Williamson
20. Dan of St. Thomas Jenifer
21. Rufus King
22. Nathaniel Gorham
23. Jonathan Dayton
24. Daniel Carroll
25. William Few
26. Abraham Baldwin
27. John Langdon
28. Nicholas Gilman
29. William Livingston
30. William Paterson
31. Thomas Mifflin
32. George Clymer
33. Thomas FitzSimons
34. Jared Ingersoll
35. Gunning Bedford, Jr.
36. Jacob Broom
37. John Dickinson
38. John Blair
39. David Brearley
40. William Jackson

a system of national courts. It could not regulate trade between the states or tax the states or their citizens. It was little more than an assembly of the representatives of 13 independent states.

In 1783, after the Revolutionary War, the nation entered a period of unstable commercial and political conditions. Alexander Hamilton and his supporters would have had little success in their campaign for a new constitution if conditions had been better. Some historians have painted the troubles of the new republic in much too gloomy colors. But little doubt remains that the situation became steadily worse after 1783. Each state acted almost like an independent country. Each ran its own affairs exactly as it saw fit, with little concern for the needs of the republic. The states circulated a dozen different currencies, most of which had little value. Neighboring states taxed each other's goods. Great Britain refused to reopen the channels of trade that the colonies had depended on for their economic well-being. The state legislatures refused to pay the debts they had assumed during the Revolutionary War. Many states passed laws that enabled debtors to escape paying their obligations.

Worst of all, some men began to think once again of taking up arms in order to solve their problems. In western Massachusetts in 1786, thousands of farmers under Captain Daniel Shays rebelled against the state government in Boston. State troops finally put down Shays' Rebellion (see SHAYS' REBELLION). George Washington and other leaders wondered whether the colonies had rebelled against Great Britain in vain. They felt it was time to end these troubles and bring peace and order by forming a new national government. This new government would have to be strong enough to gain obedience at home and respect abroad.

Representatives from five states met in Annapolis, Md., in 1786. They proposed that the states appoint commissioners to meet in Philadelphia and consider revising the Articles of Confederation (see ANNAPOLIS CONVENTION). Congress agreed to the proposal and suggested that each state select delegates to a constitutional convention.

The Constitutional Convention

The convention was supposed to open on May 14, 1787. But few of the 55 delegates had arrived in Philadelphia by that date. Finally, on May 25, the convention formally opened in Independence Hall. Twelve states had responded to the call for the convention. Rhode Island refused to send delegates because it did not want the national government to interfere with Rhode Island's affairs.

Of the 55 delegates, 39 signed the United States Constitution on Sept. 17, 1787. One of the signers was John Dickinson of Delaware, who left the convention but asked another delegate, George Read, to sign for him. William Jackson, the convention secretary, witnessed the signatures. The delegates included some of the most experienced and patriotic men in the new republic. George Washington served as president of the convention. Benjamin Franklin, at the age of 81, attended as a representative of Pennsylvania. The brilliant Alexander Hamilton represented New York. James Madison of Virginia received the title of "Father of the Constitution" with his speeches, negotiations, and attempts at compromise. Madison told the delegates they were considering a plan that "would decide forever the fate of republican government." He kept a record of the delegates' debates and decisions.

Other men who had much to do with writing the new Constitution included John Dickinson, Gouverneur Morris, Edmund Randolph, Roger Sherman, James Wilson, and George Wythe. Morris was probably the most influential delegate after Madison and Washington. He was given the task of putting all the convention's resolutions and decisions into polished form. Morris actually "wrote" the Constitution. The original copy of the document is preserved in the National Archives Building in Washington, D.C.

Several important figures of the time did not attend the convention. John Adams and Thomas Jefferson were absent on other government duties. Samuel Adams and John Jay failed to be appointed delegates from their states. Patrick Henry refused to serve after his appointment because he opposed granting any more power to the national government. Three leading members of the convention—Elbridge Gerry, George Mason, and Edmund Randolph—refused to sign the Constitution because they disagreed with parts of it.

The Background of the Constitution. The delegates to the constitutional convention relied greatly on past experience as they worked to create a new government. They recalled many important events in the development of constitutional government. These included the granting of Magna Carta, an English constitutional document, in 1215 and the meeting of the Jamestown representative assembly in 1619 (see MAGNA CARTA). Some of the American Colonies also served as examples of constitutional forms of government. They had weaknesses but had progressed beyond other governments of their time in achieving liberty under law.

About the time of the Revolutionary War, several American states established constitutional governments. In 1777, John Jay of New York had helped write a constitution for his state. John Adams of Massachusetts had helped write the Massachusetts Constitution of 1780. Delegates to the convention in Philadelphia used many ideas and words from the constitutions of these and other states.

The delegates also drew on their own experiences. For example, Franklin had proposed a plan at the Albany Congress of 1754 to unify the colonies under a central government (see ALBANY CONGRESS). Washington remembered his own problems during the war when, as commander in chief, he had to work with the weak Confederation government. Almost every delegate to the convention had served as a soldier or administrator of the government. The delegates often disagreed on details but were united in wanting the new government to be strong enough to rule the nation. They also wanted the government to respect the liberties of the states and of the people.

The Compromises. The task of creating a new government was not easily accomplished. Disputes among

the delegates nearly ended the convention on several occasions. For example, delegates from the large states disagreed with those from the small states about representation in the national legislature. The larger states favored the *Virginia Plan*, under which population would determine the number of representatives a state could send to the legislature. The small states supported the *New Jersey Plan*, which proposed that all the states would have an equal number of representatives. The Connecticut delegates suggested a compromise that settled the problem. Their plan provided for equal representation in the Senate, along with representation in proportion to population in the House of Representatives. This proposal became known as the *Connecticut Compromise* or the *Great Compromise*.

Compromises also settled conflicts over the issue of slavery. The delegates from the Northern states wanted Congress to have the power to forbid the foreign slave trade. Most Southern delegates did not wish Congress to have this power. A compromise decided that Congress would not be allowed to regulate the foreign slave trade until 1808. Another compromise involved the question of how to count slaves in determining the number of congressmen a state could have. Slaves were not considered citizens, and so the convention agreed that only three-fifths of them could be counted.

The delegates agreed that each state should hold a special convention to discuss and vote on the Constitution. They also decided that as soon as nine states had *ratified* (approved) the Constitution, the Constitution would take effect and they could begin to organize the new government.

Ratifying the Constitution

Less than three months after the Constitution was signed, Delaware became the first state to ratify it, on Dec. 7, 1787. New Hampshire was the ninth state, putting the Constitution into effect on June 21, 1788. But the Founding Fathers could not be sure that the Constitution would be generally accepted until the important states of New York and Virginia had ratified it. Powerful organized opposition to the Constitution had developed in these two states and in others. Such men as Elbridge Gerry, Patrick Henry, Richard Henry Lee, and George Mason spoke out against ratification.

Critics objected that a bill of rights had not been included, that the President had too much independence, and that the Senate was too aristocratic. They also thought Congress had too many powers and the national government had too much authority. Friends of the Constitution rallied support for ratification. They became known as *Federalists*. Their opponents were called *Anti-Federalists*. The two groups promoted their causes in newspapers, in pamphlets, and in debates in the ratifying conventions (see ANTI-FEDERALIST; FEDERALIST, THE; FEDERALIST PARTY). The groups developed into the first American political parties.

Virginia ratified the Constitution on June 25, 1788, and New York did so on July 26. Early in January, 1789, all the ratifying states except New York selected presidential electors in their legislatures or by a direct vote of the people. On February 4, the electors named George Washington as the first President of the United States. The first Congress under the Constitution met in New York City on March 4. Washington was inaugurated on April 30. But North Carolina and Rhode Island refused to approve the Constitution and take part in the new government until Congress agreed to add a bill of rights.

The Bill of Rights

The Federalists might never have obtained ratification in several important states if they had not promised to support amendments to the Constitution. These amendments were written to protect individual liberties against possible unjust rule by the national government. Most state constitutions that were adopted during the Revolution had included a clear declaration of the rights of all people. Most Americans believed that no constitution could be considered complete without such a declaration. George Mason of Virginia was responsible for the first and most famous American bill of rights, the Virginia Declaration of Rights of 1776. He and Patrick Henry might have prevented ratification of the Constitution in Virginia if the Federalists had not agreed to their demands for amendments.

James Madison led the new Congress in proposing 12 amendments to be adopted by the states under the amending process outlined in the Fifth Article of the Constitution. By Dec. 15, 1791, enough states had approved 10 of the 12 amendments to make them a permanent addition to the Constitution. These amendments are known as the *Bill of Rights*. One of the two

— INTERESTING FACTS ABOUT THE CONSTITUTION —

What two delegates to the constitutional convention became U.S. Presidents? George Washington and James Madison.

Which signers of the Declaration of Independence also signed the Constitution? George Clymer, Benjamin Franklin, Robert Morris, George Read, Roger Sherman, and James Wilson.

Who was called the "Father of the Constitution"? James Madison earned this title because he was a leading member of the convention and wrote a record of the delegates' debates.

Who actually "wrote" the Constitution? Gouverneur Morris.

When was the Constitution signed? Sept. 17, 1787.

What state did not send representatives to the constitutional convention? Rhode Island refused to send representatives because it did not want the federal government to interfere with Rhode Island's affairs.

In what order did the delegates sign the Constitution? In geographical order, starting with the northernmost state, New Hampshire, and ending with the southernmost state, Georgia.

Which three leading delegates refused to sign the Constitution? Elbridge Gerry, George Mason, and Edmund Randolph refused because they objected to the powers that the Constitution gave the federal government.

How many delegates signed the constitution? 39.

Where is the original Constitution displayed? In the National Archives Building in Washington, D.C.

rejected amendments dealt with the size of the House of Representatives. It would have changed representation from no more than one representative for every 30,000 persons to one for every 50,000 persons. The other rejected amendment provided that Congress could not change the salaries of its members until after an election of representatives had been held. See BILL OF RIGHTS.

The Development of the Constitution

Through the years, the Constitution has expanded and developed to meet the changing needs of the United States. James Madison declared, "In framing a system which we wish to last for ages, we should not lose sight of the changes which ages will produce." The Constitution was designed to serve the interests of the people—rich and poor, Northerners and Southerners, farmers, workers, and businessmen.

The Anti-Federalists accepted defeat when the Constitution was adopted, and then they set about to win power under its rules. Their action set a style for American politics that has never changed. Americans sometimes feel dissatisfied with the policies and practices of those who govern. But few Americans have condemned the constitutional system or have felt that a second constitutional convention might establish a better one.

Delegates to the constitutional convention believed strongly in the rule of the majority, but they wanted to protect minorities against any unjustness by the majority. They achieved this goal by separating and balancing the powers of government. Other basic constitutional aims included respect for the rights of individuals and states, rule by the people, separation of church and state, and supremacy of the national government.

Amendments are additions to the Constitution. By 1976, there were 26 amendments. An amendment regarding equal rights for women has been submitted to the state legislatures for ratification.

INDEX TO THE CONSTITUTION

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Amendments may be proposed by two-thirds of each house of Congress or by a national convention called by Congress. An amendment becomes part of the Constitution after being ratified either by the legislatures of three-fourths of the states or by conventions in three-fourths of the states. Congress decides which form of ratification should be used. State legislatures or conventions are given seven years in which to ratify most amendments.

Laws have added to the meaning of the Constitution. The delegates to the constitutional convention knew they could not write laws for every possible situation. Therefore, they gave Congress the right to pass all laws that were "necessary and proper" to carry out powers granted by the Constitution to the President, Congress, and federal courts. Congress has passed laws to establish such administrative organizations as the Federal Aviation Administration and the Postal Service. Congress has also passed laws to regulate commerce among the states, thereby controlling many aspects of the nation's economy.

Court Decisions. Federal and state judges apply the Constitution in many court cases. The Supreme Court has the final authority in interpreting the meaning of the Constitution in any specific case. The court has the power of *judicial review*—that is, it can declare a law unconstitutional. The Supreme Court has this power largely because of the decision of Chief Justice John Marshall in the case of *Marbury v. Madison* in 1803 (see MARBURY V. MADISON). Since that time, the court has ruled that more than 90 federal laws and hundreds of state laws were unconstitutional.

Presidential Actions. Strong Presidents have used their authority to expand the simple words of the Second Article of the Constitution into a source of great presidential power. Such Presidents include George Washington, Thomas Jefferson, Andrew Jackson, Abraham Lincoln, Theodore Roosevelt, Woodrow Wilson, and Franklin D. Roosevelt. Washington, for example, made the President the leading figure in foreign affairs. Lincoln used the powers set forth in the article to free Confederate slaves during the Civil War (1861-1865).

Customs have made the Constitution flexible and have added to the powers of the national government. For example, the President's Cabinet developed from the words in the Second Article that permit the chief executive to "require the opinion, in writing, of the principal officer in each of the executive departments, upon any subject relating to the duties of their respective offices. . . ."

State and Party Actions. The Constitution provides for a general method of electing a President. It does not mention political parties. But state laws and political-party practices have changed the constitutional system of voting into the exciting campaigns and elections that take place today.

The Constitution has continued to develop in response to the demands of an ever-growing society through all these methods. Yet the spirit and wording of the Constitution have remained constant. People of each generation have been able to apply its provisions to their own problems in ways that seem reasonable to them.

The British statesman William E. Gladstone described the Constitution as "the most wonderful work ever struck off at a given time by the brain and purpose of man." In a world of change and struggle, the American people have no more precious possession than this great document.

J. W. PELTASON

Related Articles in WORLD BOOK include:

BIOGRAPHIES

There is a biography in WORLD BOOK on each signer of the Constitution of the United States as listed after the Seventh Article. See also the following articles:

Adams, John
Adams, Samuel
Gerry, Elbridge
Henry, Patrick
Jay, John
Jefferson, Thomas
Marshall, John
Mason, George

HISTORY

Albany Congress
Annapolis Convention
Anti-Federalist
Articles of Confederation
Continental Congress
Federalist, The
Federalist Party
Founding Fathers
Shay's Rebellion
United States, History of the (Forming a New Nation)

OTHER RELATED ARTICLES

Bill of Rights
Congress of the United States
Constitution Day
Court
Fifteenth Amendment
Fifth Amendment
Government
Law
Political Party
President of the United States
States' Rights
Supreme Court of the United States
United States, Government of the
Vice-President of the United States
Voting

Outline

I. The Supreme Law of the Land
II. The Need for the Constitution
III. The Constitutional Convention
A. The Background of the Constitution
B. The Compromises
IV. Ratifying the Constitution
V. The Bill of Rights
VI. The Development of the Constitution

Questions

Why were the Articles of Confederation of 1781 inadequate for governing the United States?

What compromises were made in forming the Constitution?

What were some major objections against the newly formed Constitution?

How did controversy over the Constitution result in creating the first American political parties?

In what two states was there especially powerful organized opposition to ratifying the Constitution?

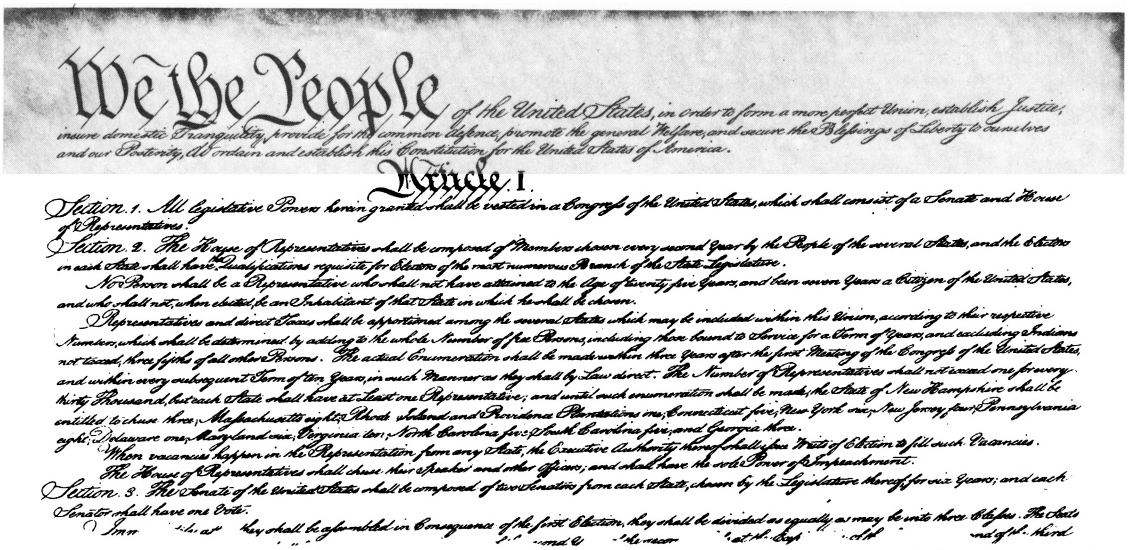
What government body has the final authority in interpreting the Constitution?

What were some of the reasons for including a bill of rights in the Constitution?

What are *delegated powers? Implied powers? Reserved powers? Concurrent powers?*

Reading and Study Guide

See *Constitution of the United States* in the RESEARCH GUIDE/INDEX, Volume 22, for a *Reading and Study Guide.*


We the People of the United States, in order to form a more perfect Union, establish Justice, insure domestic Tranquility, provide for the common Defence, promote the general Welfare, and secure the Blessings of Liberty to ourselves and our Posterity, do ordain and establish this Constitution for the United States of America.

Article. I.

Section. 1. All legislative Powers herein granted shall be vested in a Congress of the United States, which shall consist of a Senate and House of Representatives.

Section. 2. The House of Representatives shall be composed of Members chosen every second Year by the People of the several States, and the Electors in each State shall have Qualifications requisite for Electors of the most numerous Branch of the State Legislature.

No Person shall be a Representative who shall not have attained to the Age of twenty five Years, and been seven Years a Citizen of the United States, and who shall not, when elected, be an Inhabitant of that State in which he shall be chosen.

Representatives and direct Taxes shall be apportioned among the several States which may be included within this Union, according to their respective Numbers, which shall be determined by adding to the whole Number of free Persons, including those bound to Service for a Term of Years, and excluding Indians not taxed, three fifths of all other Persons. The actual Enumeration shall be made within three Years after the first Meeting of the Congress of the United States, and within every subsequent Term of ten Years, in such Manner as they shall by Law direct. The Number of Representatives shall not exceed one for every thirty Thousand, but each State shall have at least one Representative; and until such Enumeration shall be made, the State of New Hampshire shall be entitled to chuse three, Massachusetts eight, Rhode Island and Providence Plantations one, Connecticut five, New York six, New Jersey four, Pennsylvania eight, Delaware one, Maryland six, Virginia ten, North Carolina five, South Carolina five, and Georgia three.

When vacancies happen in the Representation from any State, the Executive Authority thereof shall issue Writs of Election to fill such Vacancies.

The House of Representatives shall chuse their Speaker and other Officers; and shall have the sole Power of Impeachment.

Section. 3. The Senate of the United States shall be composed of two Senators from each State, chosen by the Legislature thereof, for six Years; and each Senator shall have one Vote.

Immediately after they shall be assembled in Consequence of the first Election, they shall be divided as equally as may be into three Classes. The Seats of the Senators of the first Class shall be vacated at the Expiration of the second Year, of the second Class at the Expiration of the fourth Year, and of the third Class at the Expiration of the sixth Year, so that one third may be chosen every second Year; and if Vacancies happen by Resignation, or otherwise, during the Recess of the Legislature of any State, the Executive thereof may make temporary Appointments until the next Meeting of the Legislature, which shall then fill such Vacancies.

Historical Documents Co.—Frank H. Fleer Corp.

This Copy of the Constitution Shows the Preamble and Part of the First Article.

THE CONSTITUTION OF THE UNITED STATES

The text of the United States Constitution is printed here in boldface type. All words are given their modern spelling and capitalization. Brackets [ ] indicate parts that have been changed or set aside by amendments. The paragraphs printed in lightface type are not part of the Constitution. They explain the meaning of certain passages, or they describe how certain passages have worked in practice.

PREAMBLE

We the people of the United States, in order to form a more perfect Union, establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity, do ordain and establish this Constitution for the United States of America.

ARTICLE I

The Legislative Branch

Section 1. **All legislative powers herein granted shall be vested in a Congress of the United States, which shall consist of a Senate and House of Representatives.**

The first three articles of the Constitution divide the powers of the United States government among three separate branches: (1) the legislative branch, represented by Congress; (2) the executive branch, represented by the President; and (3) the judicial branch, represented by the Supreme Court. This division, called the *separation of powers*, is designed to prevent any branch of the government from becoming too powerful.

Article I says that only Congress has the power to make laws. Congress cannot give these powers to any other body. Through the years, however, Congress has created various federal agencies to make regulations and put its policies into practice. Such agencies include the Civil Aeronautics Board, the Federal Power Commission, and the Interstate Commerce Commission.

The two-house Congress was one of the most important compromises of the constitutional convention. The small states at the convention supported the *New Jersey plan*, under which each state would have had the same number of representatives. The large states wanted the *Virginia plan*, which provided representation based on population. As a compromise, one house was chosen according to each plan.

The House of Representatives

Section 2. **(1) The House of Representatives shall be composed of members chosen every second year by the people of the several states, and the electors in each state shall have the qualifications requisite for electors of the most numerous branch of the state legislature.**

Members of the House of Representatives are elected to two-year terms. If a person is eligible to vote for the "most numerous branch" of his or her state legislature, he or she is also eligible to vote for members of Congress. The "most numerous branch" is the house that has the most members. All states except Nebraska have a two-house state legislature. The question of who can vote for state legislators is entirely up to the state, subject to the restrictions of the Constitution. The 15th, 19th, 24th, and 26th amendments forbid the states to deny or restrict a citizen's right to vote because of race, sex, or failure to pay a tax; or age if the person is at least 18 years old.

(2) No person shall be a representative who shall not have attained to the age of twenty-five years, and been seven years a citizen of the United States, and who shall not, when elected, be an inhabitant of that state in which he shall be chosen.

Each state decides for itself the requirements for legal residence, subject to constitutional limits. Most representatives live not only in the state but also in the district from which they are chosen.

(3) Representatives and direct taxes shall be apportioned among the several states which may be included within this Union, according to their respective numbers, [which shall be determined by adding to the whole number of free persons, including those bound to service for a term of years, and excluding Indians not taxed, three-fifths of all other persons]. The actual enumeration shall be made within three years after the first meeting of the Congress of the United States, and within every subsequent term of ten years, in such manner as they shall by law direct. The number of representatives shall not exceed one for every thirty thousand, but each state shall have at least one representative; [and until such enumeration shall be made, the state of New Hampshire shall be entitled to choose 3, Massachusetts 8, Rhode Island and Providence Plantations 1, Connecticut 5, New York 6, New Jersey 4, Pennsylvania 8, Delaware 1, Maryland 6, Virginia 10, North Carolina 5, South Carolina 5, and Georgia 3].

The effect of this paragraph has been greatly changed, both by amendments and by new conditions. It now provides only three things: (1) the number of representatives given to each state shall be based on its population; (2) Congress must see that the people of the United States are counted every 10 years; and (3) each state gets at least one representative.

The words "and direct taxes" mean poll and property taxes. The 16th Amendment gives Congress the right to tax a person according to the size of his own income, rather than according to the population of the state in which he happens to live. But the phrase still forbids Congress to collect any form of direct taxation except by dividing it among the states according to population.

In the reference to "three-fifths of all other persons," the "other persons" meant Negro slaves. Since there are no longer any slaves, this part of the paragraph no longer has any meaning.

The requirement that there shall be no more than one representative for every 30,000 persons no longer has any practical force, because there is now about one representative for every 490,000. In 1929, Congress fixed the total number of representatives at 435.

(4) When vacancies happen in the representation from any state, the executive authority thereof shall issue writs of election to fill such vacancies.

If a vacancy occurs in a House seat, the state governor must call a special election to fill it. However, if the next regularly scheduled election is to be held soon, the governor may allow the seat to remain empty rather than call a special election.

(5) The House of Representatives shall choose their speaker and other officers; and shall have the sole power of impeachment.

The House chooses an officer called the *speaker* to lead meetings (see SPEAKER). The House alone has the power to bring impeachment charges against an official. The Senate tries impeachment cases. See IMPEACHMENT.

The Senate

Section 3. **(1) The Senate of the United States shall be composed of two senators from each state, [chosen by the legislature thereof,] for six years; and each senator shall have one vote.**

The Constitution at first provided that each state legislature should pick two senators. The 17th Amendment changed this rule by allowing the voters of each state to choose their own senators.

(2) Immediately after they shall be assembled in consequence of the first election, they shall be divided as equally as may be into three classes. The seats of the senators of the first class shall be vacated at the expiration of the second year, of the second class at the expiration of the fourth year, and of the third class at the expiration of the sixth year, so that one-third may be chosen every second year; [and if vacancies happen by resignation, or otherwise, during the recess of the legislature of any state, the executive thereof may make temporary appointments until the next meeting of the legislature, which shall then fill such vacancies].

Senators are elected to six-year terms. Every two years, one-third of the senators are elected and two-thirds are holdovers. This arrangement guarantees that at least two-thirds of the senators in each Congress will be experienced in the job. The 17th Amendment changed the method of filling vacancies. The governor chooses a senator until the people elect one.

(3) No person shall be a senator who shall not have attained to the age of thirty years, and been nine years a citizen of the United States, and who shall not, when elected, be an inhabitant of that state for which he shall be chosen.

In 1806, Henry Clay of Kentucky was appointed to fill an unexpired term in the Senate. He was only 29, a few months younger than the minimum age, but no one challenged the appointment. In 1793, Albert Gallatin was elected to the Senate from Pennsylvania. He was barred from taking office because he had not been a citizen for nine years.

(4) The Vice-President of the United States shall be president of the Senate, but shall have no vote, unless they be equally divided.

The Vice-President serves as president of the Senate. He votes only when a tie vote occurs. The Vice-President's power to break ties has often been important. In 1789, for example, Vice-President John Adams cast the vote that decided the President could remove Cabinet members without Senate approval.

(5) The Senate shall choose their other officers, and also a president *pro tempore*, in the absence of the Vice-President, or when he shall exercise the office of President of the United States.

The Senate elects an officer called the *president pro tempore* to lead meetings when the Vice-President is absent.

(6) The Senate shall have the sole power to try all impeachments. When sitting for that purpose, they shall be on oath or affirmation. When the President of the United States is tried, the Chief Justice shall preside: and no person shall be convicted without the concurrence of two-thirds of the members present.

The provision that the Chief Justice, rather than the Vice-President, shall preside over the Senate when a President is on trial probably grows out of the fact that a conviction would make the Vice-President the President. The phrase "on oath or affirmation" means that senators are placed under oath when trying impeachment cases, just as jurors are in a regular court trial.

(7) Judgment in cases of impeachment shall not extend further than to removal from office, and disqualification to hold and enjoy any office of honor, trust or profit under the United States: but the party convicted shall nevertheless be liable and subject to indictment, trial, judgment and punishment, according to law.

If an impeached person is found guilty, he or she

can be removed from office and forbidden to hold federal office again. The Senate cannot impose any other punishment, but the person may also be tried in regular courts. The Senate has convicted only four persons, all of them judges. These men were removed from office, but none was tried in another court.

Organization of Congress

Section 4. **(1) The times, places and manner of holding elections for senators and representatives, shall be prescribed in each state by the legislature thereof; but the Congress may at any time by law make or alter such regulations, [except as to the places of choosing senators].**

As long as state legislatures chose the senators, it would not do to let Congress fix the place of choosing. This would have amounted to giving Congress the power to tell each state where to locate its capital. The words "except as to the places of choosing senators" were set aside by the 17th Amendment.

(2) The Congress shall assemble at least once in every year, [and such meeting shall be on the first Monday in December,] unless they shall by law appoint a different day.

In Europe, kings could keep parliaments from meeting, sometimes for many years, simply by not calling them together. This is the reason for the requirement that the Congress of the United States must meet at least once a year. The 20th Amendment changed the date of the opening day of the session to January 3, unless Congress sets another date by law.

Section 5. **(1) Each house shall be the judge of the elections, returns and qualifications of its own members, and a majority of each shall constitute a quorum to do business; but a smaller number may adjourn from day to day, and may be authorized to compel the attendance of absent members, in such manner, and under such penalties as each house may provide.**

Each house determines if its members are legally qualified and have been elected fairly. In judging the qualifications of its members, each house may consider only the age, citizenship, and residence requirements set forth in the Constitution. In acting on motions to expel a member, however, either house of Congress may consider other matters bearing on that member's fitness for office. A *quorum* is a group large enough to carry on business. Discussion and debate can go on whether a quorum is present or not, as long as a quorum comes in to vote.

(2) Each house may determine the rules of its proceedings, punish its members for disorderly behavior, and, with the concurrence of two-thirds, expel a member.

Either house can expel one of its members by a two-thirds vote. Each house makes its own rules. For example, the House of Representatives puts strict time limits on debate to speed up business. It is much more difficult to end debate in the Senate. A senator may speak as long as he or she wishes unless the Senate votes for *cloture*, a motion to end debate. On most matters, cloture requires a vote of 60 senators, or three-fifths of the total Senate membership. See CLOTURE.

(3) Each house shall keep a journal of its proceedings, and from time to time publish the same, excepting such parts as may in their judgment require secrecy; and the yeas and nays of the members of either house on any question shall, at the desire of one-fifth of those present, be entered on the journal.

The journals of the two houses have been published together in the *Congressional Record* since 1873. The *Record* appears daily while Congress is in session.

A member of either house can get permission to insert a speech in the *Congressional Record* without going to the trouble of delivering it. The member can thus give the people at home the impression that he or she is speaking up in their interests, when he or she actually has not addressed Congress.

(4) Neither house, during the session of Congress, shall, without the consent of the other, adjourn for more than three days, nor to any other place than that in which the two houses shall be sitting.

Section 6. **(1) The senators and representatives shall receive a compensation for their services, to be ascertained by law, and paid out of the treasury of the United States. They shall in all cases, except treason, felony and breach of the peace, be privileged from arrest during their attendance at the session of their respective houses, and in going to and returning from the same; and for any speech or debate in either house, they shall not be questioned in any other place.**

The privilege of *immunity* (freedom from arrest) while going to and from congressional business has little importance today. Members of Congress, like anyone else, may be arrested for breaking the law. They may be tried, convicted, and sent to prison.

Congressional immunity from charges of *libel* and *slander* remains important. Libel is an untrue written statement that damages a person's reputation. Slander is a spoken statement that does so. Immunity means that a member of Congress may say whatever he wishes in connection with congressional business without fear of being sued. This immunity extends to anything said during debate, in an official report, or while voting.

(2) No senator or representative shall, during the time for which he was elected, be appointed to any civil office under the authority of the United States, which shall have been created, or the emoluments whereof shall have been increased during such time; and no person holding any office under the United States, shall be a member of either house during his continuance in office.

These provisions keep congressmen from creating jobs to which they can later be appointed, or from raising salaries of jobs they hope to hold in the future.

In 1909, Senator Philander C. Knox resigned from the Senate to become secretary of state. But the salary of the secretary of state had been increased during Knox's term as senator. In order that Knox might accept the post, Congress withdrew the salary increase for the period of Knox's unfinished term.

Section 7. **(1) All bills for raising revenue shall originate in the House of Representatives; but the Senate may propose or concur with amendments as on other bills.**

Tax bills must originate in the House. The tradition that tax laws should originate in the lower house of the legislature came from England. There, the lower house—the House of Commons—is more likely to reflect the people's wishes because the people elect its members. They do not elect the upper house, the House of Lords. In the United States, this rule has little importance because the people elect both the Senate and the House. In addition, the Senate can amend a tax bill to such an extent that it rewrites the whole measure.

(2) Every bill which shall have passed the House of Representatives and the Senate, shall, before it become a law, be presented to the President of the United

States; if he approve he shall sign it, but if not he shall return it, with his objections to that house in which it shall have originated, who shall enter the objections at large on their journal, and proceed to reconsider it. If after such reconsideration two-thirds of that house shall agree to pass the bill, it shall be sent, together with the objections, to the other house, by which it shall likewise be reconsidered, and if approved by two-thirds of that house, it shall become a law. But in all such cases the votes of both houses shall be determined by yeas and nays, and the names of the persons voting for and against the bill shall be entered on the journal of each house respectively. If any bill shall not be returned by the President within ten days (Sundays excepted) after it shall have been presented to him, the same shall be a law, in like manner as if he had signed it, unless the Congress by their adjournment prevent its return, in which case it shall not be a law.

A bill passed by Congress goes to the President for his signature. If the President disapproves the bill, he must return it to Congress with a statement of his objections within 10 days, not including Sundays. This action is called a *veto*. Congress can pass a law over the President's veto by a two-thirds vote of each house. The President can also let a bill become law without his signature merely by letting 10 days pass. But a bill sent to the President during the last 10 days of a session of Congress cannot become law unless he signs it. If a bill the President dislikes reaches him near the end of a session, he may simply hold it without signing. When Congress adjourns, the bill is killed. This practice is known as a *pocket veto*. It is used by Presidents who find a bill unsatisfactory but do not want to veto it openly. See VETO.

(3) Every order, resolution, or vote to which the concurrence of the Senate and House of Representatives may be necessary (except on a question of adjournment) shall be presented to the President of the United States; and before the same shall take effect, shall be approved by him, or being disapproved by him, shall be repassed by two-thirds of the Senate and House of Representatives, according to the rules and limitations prescribed in the case of a bill.

Powers Granted to Congress

Section 8. **The Congress shall have power:**

(1) To lay and collect taxes, duties, imposts and excises, to pay the debts and provide for the common defense and general welfare of the United States; but all duties, imposts and excises shall be uniform throughout the United States;

Duties are taxes on goods coming into the United States. *Excises* are taxes on sales, use, or production, and sometimes on business procedures or privileges. For example, corporation taxes, cigarette taxes, and amusement taxes are excises. *Imposts* is a general tax term that includes both duties and excises.

(2) To borrow money on the credit of the United States;

(3) To regulate commerce with foreign nations, and among the several states, and with the Indian tribes;

This section, called the *commerce clause*, gives Congress some of its most important powers. The Supreme Court has interpreted *commerce* to mean not only trade but also all kinds of commercial activity. Commerce "among the several states" is usually called *interstate commerce*. The Supreme Court has ruled that interstate commerce includes not only transactions across state boundaries but also any activity that affects commerce in more than one state. The court has interpreted the word *regulate* to mean *encourage*, *promote*, *protect*, *prohibit*, or *restrain*. As a result, Congress can pass laws and provide funds to improve waterways, to enforce air safety measures, and to forbid interstate shipment of certain goods. It can regulate the movement of people, of trains, of stocks and bonds, and even of television signals. Congress has made it a federal crime to flee across state lines from state or local police. It also has forbidden people who operate interstate facilities or who serve interstate passengers to treat customers unfairly because of race. See INTERSTATE COMMERCE.

(4) To establish an uniform rule of naturalization, and uniform laws on the subject of bankruptcies throughout the United States;

(5) To coin money, regulate the value thereof, and of foreign coin, and fix the standard of weights and measures;

From this section, along with the section that allows the Congress to regulate commerce and to borrow money, Congress gets its right to charter national banks and to establish the Federal Reserve System. See FEDERAL RESERVE SYSTEM.

(6) To provide for the punishment of counterfeiting the securities and current coin of the United States;

Securities are government bonds.

(7) To establish post offices and post roads;

(8) To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries;

Photographs and films may also be copyrighted under this rule (see COPYRIGHT; PATENT).

(9) To constitute tribunals inferior to the Supreme Court;

Examples of federal courts "inferior to the Supreme Court" include the United States district courts and the U.S. Court of Appeals.

(10) To define and punish piracies and felonies committed on the high seas, and offenses against the law of nations;

Congress, rather than the states, has jurisdiction over crimes committed at sea.

(11) To declare war, grant letters of marque and reprisal, and make rules concerning captures on land and water;

Only Congress can declare war. However, the President, as commander in chief, has engaged the United States in wars without a declaration by Congress. Undeclared wars include the Korean War (1950-1953) and the Vietnam War (1957-1975). *Letters of marque and reprisal* are documents that authorize private vessels to attack enemy shipping (see MARQUE AND REPRISAL).

(12) To raise and support armies, but no appropriation of money to that use shall be for a longer term than two years;

(13) To provide and maintain a navy;

(14) To make rules for the government and regulation of the land and naval forces;

(15) To provide for calling forth the militia to execute the laws of the Union, suppress insurrections and repel invasions;

Congress has given the President power to decide

when a state of invasion or *insurrection* (uprising) exists. At such times, the President can call out the National Guard.

(16) To provide for organizing, arming, and disciplining, the militia, and for governing such part of them as may be employed in the service of the United States, reserving to the states respectively, the appointment of the officers, and the authority of training the militia according to the discipline prescribed by Congress;

The federal government helps the states maintain the militia, also known as the National Guard. Until 1916, the states controlled the militia entirely. That year, the National Defense Act provided for federal funding of the guard and for drafting the guard into national service under certain circumstances.

(17) To exercise exclusive legislation in all cases whatsoever, over such district (not exceeding ten miles square) as may, by cession of particular states, and the acceptance of Congress, become the seat of the government of the United States, and to exercise like authority over all places purchased by the consent of the legislature of the state in which the same shall be for the erection of forts, magazines, arsenals, dockyards, and other needful buildings;—And

This section makes Congress the legislative body not only for the District of Columbia, but for federal property on which forts, naval bases, arsenals, and other federal works or buildings are located.

(18) To make all laws which shall be necessary and proper for carrying into execution the foregoing powers, and all other powers vested by this Constitution in the government of the United States, or in any department or officer thereof.

This section, the famous "necessary and proper" clause, allows Congress to deal with many matters not specifically mentioned in the Constitution. As times have changed, Congress has been able to pass needed laws with few amendments to the Constitution. This flexibility helps explain why the Constitution is one of the oldest written constitutions.

Powers Forbidden to Congress

Section 9. **(1) The migration or importation of such persons as any of the states now existing shall think proper to admit, shall not be prohibited by the Congress prior to the year one thousand eight hundred and eight, but a tax or duty may be imposed on such importation, not exceeding ten dollars for each person.**

This paragraph refers to the slave trade. Dealers in slaves, as well as some slaveholders, wanted to make sure that Congress could not stop anyone from bringing African slaves into the country before the year 1808. That year, Congress did ban the importing of slaves.

(2) The privilege of the writ of *habeas corpus* shall not be suspended, unless when in cases of rebellion or invasion the public safety may require it.

A *writ of habeas corpus* is a legal order that commands people who have a person in custody to bring the person into court. They must explain in court why the person is being restrained. If their explanation is unsatisfactory, the judge can order the prisoner released. See HABEAS CORPUS.

(3) No bill of attainder or *ex post facto* law shall be passed.

A *bill of attainder* is an act passed by a legislature to punish a person without trial. An *ex post facto law* is one that provides punishment for an act that was not illegal when the act was committed. See ATTAINDER; EX POST FACTO.

(4) No capitation, [or other direct,] tax shall be laid, unless in proportion to the census or enumeration herein before directed to be taken.

A *capitation* is a tax collected equally from everyone. It is also called a *head tax* or a *poll tax*. The Supreme Court held that this section prohibits an income tax, but the 16th Amendment set aside the court's decision.

(5) No tax or duty shall be laid on articles exported from any state.

In this sentence, *exported* means sent to other states or to foreign countries. The Southern states feared that the new government would tax their exports and that their economies would suffer as a result. This sentence forbids such a tax. However, Congress can prohibit shipment of certain items or regulate the conditions of their shipment.

(6) No preference shall be given by any regulation of commerce or revenue to the ports of one state over those of another: nor shall vessels bound to, or from, one state, be obliged to enter, clear, or pay duties in another.

Congress cannot make laws concerning trade that favor one state over another. Ships going from one state to another need not pay taxes to do so.

(7) No money shall be drawn from the treasury, but in consequence of appropriations made by law; and a regular statement and account of the receipts and expenditures of all public money shall be published from time to time.

Government money cannot be spent without the consent of Congress. Congress must issue a financial statement from time to time. Congress authorizes money for most government programs in lump sums because too much time would be needed to authorize each item separately.

(8) No title of nobility shall be granted by the United States: And no person holding any office of profit or trust under them, shall, without the consent of the Congress, accept of any present, emolument, office, or title, of any kind whatever, from any king, prince, or foreign state.

Congress cannot give anyone a title of nobility, such as countess or duke. Federal officials may not accept a gift, office, payment, or title from a foreign country without the consent of Congress.

Powers Forbidden to the States

Section 10. **(1) No state shall enter into any treaty, alliance, or confederation; grant letters of marque and reprisal; coin money; emit bills of credit; make anything but gold and silver coin a tender in payment of debts; pass any bill of attainder, *ex post facto* law, or law impairing the obligation of contracts, or grant any title of nobility.**

(2) No state shall, without the consent of the Congress, lay any imposts or duties on imports or exports, except what may be absolutely necessary for executing its inspection laws: and the net produce of all duties and imposts, laid by any state on imports or exports, shall be for the use of the treasury of the United States; and all such laws shall be subject to the revision and control of the Congress.

Without the consent of Congress, a state cannot tax goods entering or leaving the state except for small fees to cover the cost of inspection. Profits from a tax on interstate commerce go to the federal government.

(3) No state shall, without the consent of Congress, lay any duty of tonnage, keep troops, or ships of war in time of peace, enter into any agreement or compact with another state, or with a foreign power, or engage in war, unless actually invaded, or in such imminent danger as will not admit of delay.

Only the federal government has the power to make treaties and to carry out measures for national defense.

ARTICLE II

The Executive Branch

Section 1. (1) The executive power shall be vested in a President of the United States of America. He shall hold his office during the term of four years, and, together with the Vice-President, chosen for the same term, be elected, as follows:

(2) Each state shall appoint, in such manner as the legislature thereof may direct, a number of electors, equal to the whole number of senators and representatives to which the state may be entitled in the Congress: but no senator or representative, or person holding an office of trust or profit under the United States, shall be appointed an elector.

This section establishes the Electoral College, a group of people chosen by the voters of each state to elect the President and Vice-President (see ELECTORAL COLLEGE).

(3) [The electors shall meet in their respective states, and vote by ballot for two persons, of whom one at least shall not be an inhabitant of the same state with themselves. And they shall make a list of all the persons voted for, and of the number of votes for each; which list they shall sign and certify, and transmit sealed to the seat of the government of the United States, directed to the president of the Senate. The president of the Senate shall, in the presence of the Senate and House of Representatives, open all the certificates, and the votes shall then be counted. The person having the greatest number of votes shall be the President, if such number be a majority of the whole number of electors appointed; and if there be more than one who have such majority, and have an equal number of votes, then the House of Representatives shall immediately choose by ballot one of them for President; and if no person have a majority, then from the five highest on the list the said House shall in like manner choose the President. But in choosing the President, the votes shall be taken by states, the representation from each state having one vote; a quorum for this purpose shall consist of a member or members from two-thirds of the states, and a majority of all the states shall be necessary to a choice. In every case, after the choice of the President, the person having the greatest number of votes of the electors shall be the Vice-President. But if there should remain two or more who have equal votes, the Senate shall choose from them by ballot the Vice-President.]

The 12th Amendment changed this procedure for electing the President and Vice-President.

(4) The Congress may determine the time of choosing the electors, and the day on which they shall give their votes; which day shall be the same throughout the United States.

(5) No person except a natural-born citizen, or a citizen of the United States at the time of the adoption of this Constitution, shall be eligible to the office of President; neither shall any person be eligible to that office who shall not have attained to the age of thirty-five years, and been fourteen years a resident within the United States.

(6) In case of the removal of the President from office, or of his death, resignation, or inability to discharge the powers and duties of the said office, the same shall devolve on the Vice-President, and the Congress may by law provide for the case of removal, death, resignation or inability, both of the President and Vice-President, declaring what officer shall then act as President, and such officer shall act accordingly, until the disability be removed, or a President shall be elected.

On Aug. 9, 1974, President Richard M. Nixon resigned as chief executive and was succeeded by Vice-President Gerald R. Ford. Until then, only death had ever cut short the term of a President of the United States. See PRESIDENTIAL SUCCESSION.

(7) The President shall, at stated times, receive for his services, a compensation, which shall neither be increased nor diminished during the period for which he shall have been elected, and he shall not receive within that period any other emolument from the United States, or any of them.

The Constitution made it possible for a poor person to become President by providing a salary for that office. The President's salary cannot be raised or lowered during his or her term of office. The chief executive may not receive any other pay from the federal government or the states.

(8) Before he enter on the execution of his office, he shall take the following oath or affirmation:—"I do solemnly swear (or affirm) that I will faithfully execute the Office of President of the United States, and will to the best of my Ability, preserve, protect and defend the Constitution of the United States."

The Constitution does not say who shall administer the oath to the newly elected President. President George Washington was sworn in by Robert R. Livingston, then a state official in New York. After that, it became customary for the Chief Justice of the United States to administer the oath. Calvin Coolidge was sworn in by his father, a justice of the peace, at his home in Vermont. Coolidge took the oath again before Justice Adolph A. Hoehling of the Supreme Court of the District of Columbia.

Section 2. (1) The President shall be commander in chief of the Army and Navy of the United States, and of the militia of the several states, when called into the actual service of the United States; he may require the opinion, in writing, of the principal officer in each of the executive departments, upon any subject relating to the duties of their respective offices, and he shall have power to grant reprieves and pardons for offenses against the United States, except in cases of impeachment.

The President's powers as commander in chief are far-reaching. But even in wartime, the President must obey the law of the land.

(2) He shall have power, by and with the advice and

consent of the Senate, to make treaties, provided two-thirds of the senators present concur; and he shall nominate, and by and with the advice and consent of the Senate, shall appoint ambassadors, other public ministers and consuls, judges of the Supreme Court, and all other officers of the United States, whose appointments are not herein otherwise provided for, and which shall be established by law: but the Congress may by law vest the appointment of such inferior officers, as they think proper, in the President alone, in the courts of law, or in the heads of departments.

The framers of the Constitution intended that in some matters the Senate should serve as an advisory body for the President, somewhat as the House of Lords advised the king in Great Britain.

The President has the power to make treaties and to appoint various government officials, but two-thirds of the senators must approve before a treaty or appointment is confirmed.

(3) The President shall have power to fill up all vacancies that may happen during the recess of the Senate, by granting commissions which shall expire at the end of their next session.

This means that when the Senate is not in session, the President can make temporary appointments to offices which require Senate confirmation.

Section 3. **He shall from time to time give to the Congress information of the state of the Union, and recommend to their consideration such measures as he shall judge necessary and expedient; he may, on extraordinary occasions, convene both houses, or either of them, and in case of disagreement between them, with respect to the time of adjournment, he may adjourn them to such time as he shall think proper; he shall receive ambassadors and other public ministers; he shall take care that the laws be faithfully executed, and shall commission all the officers of the United States.**

The President gives his State of the Union message to Congress each year. Presidents George Washington and John Adams delivered their messages in person. For more than 100 years after that, most Presidents sent a written message, which was read in Congress. President Woodrow Wilson delivered his messages in person, as did President Franklin D. Roosevelt and all Presidents after Roosevelt. The President's messages often have great influence on public opinion, and thus on Congress. Famous messages to Congress include the Monroe Doctrine and President Wilson's "Fourteen Points."

During the 1800's, Presidents often used their power to call Congress into session. Today, Congress is in session most of the time. The President has never had to adjourn Congress.

The responsibility to "take care that the laws be faithfully executed" puts the President at the head of law enforcement for the national government. Every federal official, civilian or military, gets his or her authority from the President.

Section 4. **The President, Vice-President and all civil officers of the United States, shall be removed from office on impeachment for, and conviction of, treason, bribery, or other high crimes and misdemeanors.**

ARTICLE III

The Judicial Branch

Section 1. **The judicial power of the United States, shall be vested in one Supreme Court, and in such inferior courts as the Congress may from time to time ordain and establish. The judges, both of the Supreme and inferior courts, shall hold their offices during good behavior, and shall, at stated times, receive for their services, a compensation, which shall not be diminished during their continuance in office.**

The Constitution makes every effort to keep the courts independent of both the legislature and the President. The guarantee that judges shall hold office during "good behavior" means that, unless they are impeached and convicted, they can hold office for life. This protects a judge from any threat of dismissal by the President who appointed him, or by any other President during the judge's lifetime. The rule that a judge's salary may not be reduced protects him against pressure from Congress, which could otherwise threaten to fix his salary so low that he could be forced to resign. See COURT; SUPREME COURT OF THE UNITED STATES.

Section 2. **(1) The judicial power shall extend to all cases, in law and equity, arising under this Constitution, the laws of the United States, and treaties made, or which shall be made, under their authority;—to all cases affecting ambassadors, other public ministers and consuls;—to all cases of admiralty and maritime jurisdiction;—to controversies to which the United States shall be a party;—to controversies between two or more states; [between a state and citizens of another state;] between citizens of different states;—between citizens of the same state claiming lands under grants of different states, and between a state, or the citizens thereof, and foreign states, [citizens or subjects].**

The right of the federal courts to handle "cases arising under this Constitution" is the basis of the Supreme Court's right to declare laws of Congress unconstitutional. This right of "judicial review" was established by Chief Justice John Marshall's historic decision in the case of *Marbury v. Madison* (see MARBURY V. MADISON).

The 11th Amendment set aside the phrase *between a state and citizens of another state.* A citizen of one state cannot sue another state in a federal court.

(2) In all cases affecting ambassadors, other public ministers and consuls, and those in which a state shall be party, the Supreme Court shall have original jurisdiction. In all the other cases before mentioned, the Supreme Court shall have appellate jurisdiction, both as to law and fact, with such exceptions, and under such regulations as the Congress shall make.

The statement that the Supreme Court has *original jurisdiction* in cases affecting the representatives of foreign countries and in cases to which a state is one of the parties means that cases of this kind go directly to the Supreme Court. In other kinds of cases, the Supreme Court has *appellate jurisdiction.* This means that the cases are tried first in a lower court and may come up to the Supreme Court for review if Congress authorizes an appeal. Congress cannot take away or modify the original jurisdiction of the Supreme Court, but it can take away the right to appeal to that court or fix the conditions one must meet to present an appeal.

(3) The trial of all crimes, except in cases of impeachment, shall be by jury; and such trial shall be held in the state where the said crimes shall have been committed; but when not committed within any state, the trial shall be at such place or places as the Congress may by law have directed.

Section 3. **(1) Treason against the United States, shall consist only in levying war against them, or in adhering**

to their enemies, giving them aid and comfort. No person shall be convicted of treason unless on the testimony of two witnesses to the same overt act, or on confession in open court.

No person can be convicted of treason against the United States unless he or she confesses in open court, or unless two witnesses testify that he or she has committed a treasonable act. Talking or thinking about committing a treasonable act is not treason. See TREASON.

(2) The Congress shall have power to declare the punishment of treason, but no attainder of treason shall work corruption of blood, or forfeiture except during the life of the person attainted.

The phrase *no attainder of treason shall work corruption of blood* means that the family of a traitor does not share the guilt. Formerly, an offender's family could also be punished.

ARTICLE IV

Relation of the States to Each Other

Much of this article was taken word for word from the old Articles of Confederation.

Section 1. **Full faith and credit shall be given in each state to the public acts, records, and judicial proceedings of every other state. And the Congress may by general laws prescribe the manner in which such acts, records and proceedings shall be proved, and the effect thereof.**

This section requires the states to honor one another's laws, records, and court rulings. The rule prevents a person from avoiding justice by leaving a state.

Section 2. **(1) The citizens of each state shall be entitled to all privileges and immunities of citizens in the several states.**

This means that citizens traveling from state to state are entitled to all the privileges and immunities that automatically go to citizens of those states. Some privileges, such as the right to vote, do not automatically go with citizenship, but require a period of residence and perhaps other qualifications. The word *citizen* in this provision does not include corporations.

(2) A person charged in any state with treason, felony, or other crime, who shall flee from justice, and be found in another state, shall on demand of the executive authority of the state from which he fled, be delivered up, to be removed to the state having jurisdiction of the crime.

If a person commits a crime in one state and flees to another state, the governor of the state in which the crime was committed can demand that the fugitive be handed over. The process of returning an accused person is called *extradition.* In a few cases, the governor has refused to extradite. He might do so because the crime was committed many years ago, or because he believed the accused would not get a fair trial in the other state. It is not clear how the federal government could enforce this section. See EXTRADITION.

(3) [No person held to service or labor in one state, under the laws thereof, escaping into another, shall, in consequence of any law or regulation therein, be discharged from such service or labor, but shall be delivered up on claim of the party to whom such service or labor may be due.]

A "person held to service or labor" was a slave or an *indentured servant* (a person bound by contract to serve someone for several years). No one is now bound to servitude in the United States, so this part of the Constitution no longer has any force.

Federal-State Relations

Section 3. **(1) New states may be admitted by the Congress into this Union; but no new state shall be formed or erected within the jurisdiction of any other state; nor any state be formed by the junction of two or more states, or parts of states, without the consent of the legislatures of the states concerned as well as of the Congress.**

New states cannot be formed by dividing or joining existing states without the consent of the state legislatures and Congress. During the Civil War (1861-1865), Virginia fought for the Confederacy, but people in the western part of the state supported the Union. After West Virginia split from Virginia, Congress accepted the new state on the ground that Virginia had rebelled.

(2) The Congress shall have power to dispose of and make all needful rules and regulations respecting the territory or other property belonging to the United States; and nothing in this Constitution shall be so construed as to prejudice any claims of the United States, or of any particular state.

Section 4. **The United States shall guarantee to every state in this Union a republican form of government, and shall protect each of them against invasion; and on application of the legislature, or of the executive (when the legislature cannot be convened) against domestic violence.**

This section requires the federal government to make sure that every state has a "republican form of government." A republican government is one in which the people elect representatives to govern. The Supreme Court ruled that Congress, not the courts, must decide whether a state government is republican. According to the court, if Congress admits a state's senators and representatives, that action indicates that Congress considers the state's government republican.

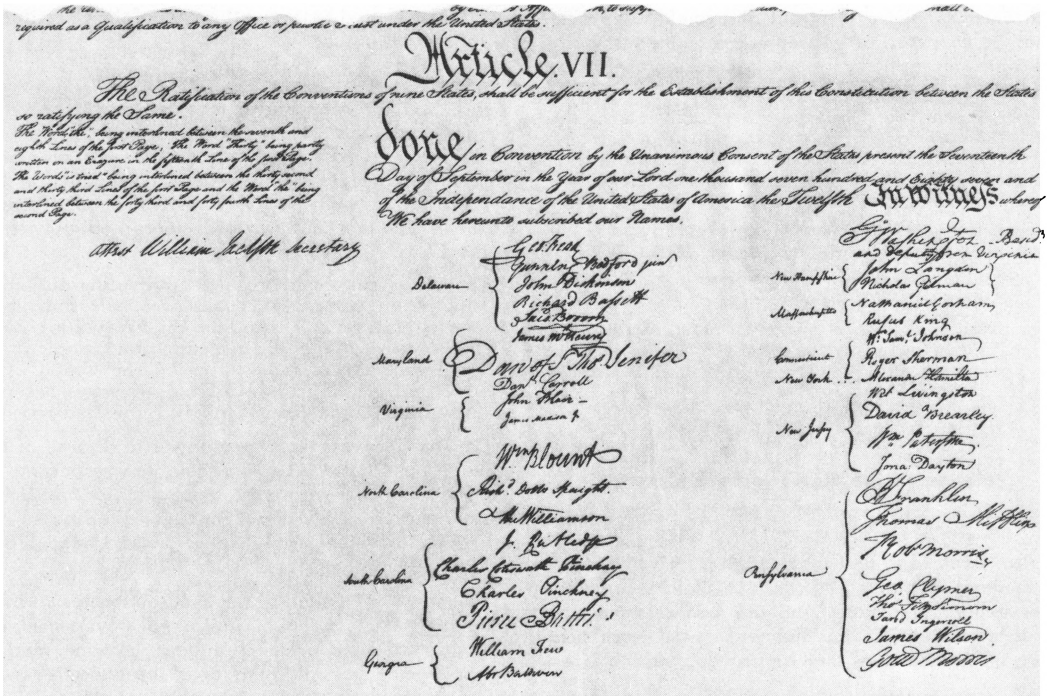
The legislature or governor of a state can request federal aid in dealing with riots or other internal violence. During the Pullman strike of 1894, the federal government sent troops to Illinois even though the state governor said he did not want them (see PULLMAN STRIKE).

ARTICLE V

Amending the Constitution

The Congress, whenever two-thirds of both houses shall deem it necessary, shall propose amendments to this Constitution, or, on the application of the legislatures of two-thirds of the several states, shall call a convention for proposing amendments, which, in either case, shall be valid to all intents and purposes, as part of this Constitution, when ratified by the legislatures of three-fourths of the several states, or by conventions in three-fourths thereof, as the one or the other mode of ratification may be proposed by the Congress; provided [that no amendment which may be made prior to the year one thousand eight hundred and eight shall in any manner affect the first and fourth clauses in the ninth section of the first article; and] that no state, without its consent, shall be deprived of its equal suffrage in the Senate.

Amendments may be proposed by a two-thirds vote of each house of Congress or by a national convention



Historical Documents Co.—Frank H. Fleer Corp.

The Last Section of the Constitution Bears the Signatures of the Delegates.

called by Congress at the request of two-thirds of the states. To become part of the Constitution, amendments must be *ratified* (approved) by the legislature of three-fourths of the states or by a convention in three-fourths of the states.

The framers of the Constitution purposely made it hard to put through an amendment. Congress has considered more than 7,000 amendments, but it has passed only 32 and submitted them to the states. Of these, only 26 have been ratified, and one is still being considered by the state legislatures. Only one amendment, the 21st, was ratified by state conventions. All the others were ratified by state legislatures.

The Constitution sets no time limit during which the states must ratify a proposed amendment. But the courts have held that amendments must be ratified within a "reasonable time" and that Congress decides what is reasonable. Since the early 1900's, most proposed amendments have included a requirement that the necessary ratification be obtained within seven years.

ARTICLE VI

National Debts

(1) All debts contracted and engagements entered into, before the adoption of this Constitution, shall be as valid against the United States under this Constitution, as under the Confederation.

This section promises that all debts and obligations made by the United States before the adoption of the Constitution will be honored.

Supremacy of the National Government

(2) This Constitution, and the laws of the United States which shall be made in pursuance thereof; and all treaties made, or which shall be made, under the authority of the United States, shall be the supreme law of the land; and the judges in every state shall be bound thereby, anything in the constitution or laws of any state to the contrary notwithstanding.

This section, known as the *supremacy clause*, has been called *the linchpin of the Constitution*—that is, the part that keeps the entire structure from falling apart. It means simply that when state laws conflict with national laws, the national laws are superior.

(3) The senators and representatives before mentioned, and the members of the several state legislatures, and all executive and judicial officers, both of the United States and of the several states, shall be bound by oath or affirmation, to support this Constitution; but no religious test shall ever be required as a qualification to any office or public trust under the United States.

This section requires both federal and state officials to give supreme allegiance to the Constitution of the United States rather than to the constitution of any state. The section also forbids any kind of religious test for holding federal office. It applies only to the national government, but the 14th Amendment applies the same rule to state and local governments.

ARTICLE VII

Ratifying the Constitution

The ratification of the conventions of nine states, shall be sufficient for the establishment of this Constitution between the states so ratifying the same.

Done in convention by the unanimous consent of the states present the seventeenth day of September in the year of our Lord one thousand seven hundred and eighty-seven and of the independence of the United

States of America the twelfth. In witness whereof we have hereunto subscribed our names,

George Washington—President and deputy from Virginia

Delaware

George Read
Gunning Bedford, Jr.
John Dickinson
Richard Bassett
Jacob Broom

Maryland

James McHenry
Dan of St. Thomas Jenifer
Daniel Carroll

Virginia

John Blair
James Madison, Jr.

North Carolina

William Blount
Richard Dobbs Spaight
Hugh Williamson

South Carolina

John Rutledge
Charles Cotesworth Pinckney
Charles Pinckney
Pierce Butler

Georgia

William Few
Abraham Baldwin

New Hampshire

John Langdon
Nicholas Gilman

Massachusetts

Nathaniel Gorham
Rufus King

Connecticut

William Samuel Johnson
Roger Sherman

New York

Alexander Hamilton

New Jersey

William Livingston
David Brearley
William Paterson
Jonathan Dayton

Pennsylvania

Benjamin Franklin
Thomas Mifflin
Robert Morris
George Clymer
Thomas FitzSimons
Jared Ingersoll
James Wilson
Gouverneur Morris

AMENDMENTS TO THE CONSTITUTION

THE BILL OF RIGHTS

The first 10 amendments, known as the *Bill of Rights*, were proposed on Sept. 25, 1789. They were ratified on Dec. 15, 1791. They were adopted because some states refused to approve the Constitution unless a bill of rights was added.

The amendments protect individuals from various unjust acts of government. Originally, the amendments applied only to the federal government. But the 14th Amendment declares that no state can deprive any person of life, liberty, or property without "due process of law." The Supreme Court has interpreted those words to mean that most of the Bill of Rights applies to the states as well. See BILL OF RIGHTS.

AMENDMENT 1

Freedom of Religion, Speech, and the Press; Rights of Assembly and Petition

Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the government for a redress of grievances.

Many countries have made one religion the *established* (official) church and supported it with government funds. This amendment forbids Congress to set up or in any way provide for an established church. In addition, Congress may not pass laws limiting worship, speech, or the press, or preventing people from meeting peacefully. Congress also may not keep people from asking the government for relief from unfair treatment.

All the rights protected by this amendment have limits. For example, the guarantee of freedom of religion does not mean that the government must allow all religious practices. In the 1800's, some Mormons believed it was a man's religious duty to have more than one wife. The Supreme Court ruled that Mormons had to obey the laws forbidding that practice. See FREEDOM OF RELIGION; FREEDOM OF SPEECH; FREEDOM OF THE PRESS.

AMENDMENT 2

Right to Bear Arms

A well-regulated militia, being necessary to the security of a free state, the right of the people to keep and bear arms shall not be infringed.

This amendment prohibits only the national government from limiting the right to carry weapons. The amendment was adopted so that Congress could not disarm a state militia.

AMENDMENT 3

Housing of Soldiers

No soldier shall, in time of peace be quartered in any house, without the consent of the owner, nor in time of war, but in a manner to be prescribed by law.

This amendment grew directly out of an old complaint against the British, who had forced people to take soldiers into their homes.

AMENDMENT 4

Search and Arrest Warrants

The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

This measure does not forbid legal authorities to search, to seize goods, or to arrest people. It simply requires that in most cases the authorities obtain a search or arrest warrant from a judge by showing the need for it. See SEARCH WARRANT.

AMENDMENT 5

Rights in Criminal Cases

No person shall be held to answer for a capital, or otherwise infamous crime, unless on a presentment or indictment of a grand jury, except in cases arising in the land or naval forces, or in the militia, when in actual service in time of war or public danger; nor shall any person be subject for the same offense to be twice put in jeopardy of life or limb; nor shall be compelled in any criminal case to be a witness against himself, nor be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use, without just compensation.

A *capital crime* is one punishable by death. An *infamous crime* is one punishable by death or imprisonment. This amendment guarantees that no one has to stand trial for such a federal crime unless a *grand jury* has *indicted* (accused) him. A grand jury is a special group of people selected to decide whether there is enough evidence against a person to hold a trial. A person cannot be *put in double jeopardy* (tried twice) for the same offense by the same government. But he may be tried a second time if a jury cannot agree on a verdict, if a mistrial is declared for some other reason, or if he requests a new trial. The

amendment also guarantees that a person cannot be forced to testify against himself.

The statement that no person shall be deprived of life, liberty, or property "without due process of law" expresses one of the most important rules of the Constitution. The same words are in the 14th Amendment as restrictions on the power of the states. The phrase expresses the idea that a person's life, liberty, and property are not subject to the uncontrolled power of the government. This idea can be traced to Magna Carta, which provided that the king could not imprison or harm a person "except by the lawful judgment of his peers or by the law of the land." Due process is a vague rule, and the Supreme Court has applied it to widely different cases. Until the mid-1900's, the court used the due-process rule to strike down laws that prevented people from using their property as they wished. For example, the court overturned the Missouri Compromise, which prohibited slavery in the U.S. territories. The court said the compromise unjustly prevented slave owners from taking slaves—their property—into the territories. Today, the courts use the due-process rule to strike down laws that interfere with personal liberty. See DUE PROCESS OF LAW.

The amendment also forbids the government to take a person's property for public use without fair payment. The government's right to take property for public use is called *eminent domain*. Governments use it to acquire land for highways, schools, and other public facilities. See FIFTH AMENDMENT.

AMENDMENT 6

Rights to a Fair Trial

In all criminal prosecutions, the accused shall enjoy the right to a speedy and public trial, by an impartial jury of the state and district wherein the crime shall have been committed, which district shall have been previously ascertained by law, and to be informed of the nature and cause of the accusation; to be confronted with the witnesses against him; to have compulsory process for obtaining witnesses in his favor, and to have the assistance of counsel for his defense.

A person accused of crime must have a prompt, public trial by an open-minded jury. The requirement for a speedy and public trial grew out of the fact that some political trials in England had been delayed for years and then were held in secret. An accused person must be informed of the charges against him and must be allowed to meet the witnesses against him face to face. Otherwise, an innocent person may be punished if a court allows the testimony of unknown witnesses to be used as evidence. This amendment guarantees that a person on trial can face and cross-examine those who have accused him. He may be able to show that his accuser lied or made a mistake. Finally, an accused person must have a lawyer to defend him if he wants one.

AMENDMENT 7

Rights in Civil Cases

In suits at common law, where the value in controversy shall exceed twenty dollars, the right of trial by jury shall be preserved, and no fact tried by a jury, shall be otherwise re-examined in any court of the United States, than according to the rules of the common law.

The framers of the Constitution considered the right to jury trial extremely important. In the Sixth Amendment, they provided for jury trials in criminal cases. In the Seventh Amendment, they provided for such trials in civil suits where the amount contested exceeds $20. The amendment applies only to federal courts. But most state constitutions also call for jury trials in civil cases.

AMENDMENT 8

Bails, Fines, and Punishments

Excessive bail shall not be required, nor excessive fines imposed, nor cruel and unusual punishments inflicted.

Bails, fines, and punishments must be fair and humane. In the case of *Furman v. Georgia*, the Supreme Court ruled in 1972 that capital punishment, as it was then imposed, violated this amendment. The court held that the death penalty was cruel and unusual punishment because it was not applied fairly and uniformly. After that decision, many states adopted new capital-punishment laws designed to meet the Supreme Court's objections. But the status of the death penalty remained unclear because the court had not yet reviewed the new laws. See CAPITAL PUNISHMENT.

AMENDMENT 9

Rights Retained by the People

The enumeration in the Constitution, of certain rights, shall not be construed to deny or disparage others retained by the people.

Some people feared that the listing of some rights in the Bill of Rights would be interpreted to mean that other rights not listed were not protected. This amendment was adopted to prevent such an interpretation.

AMENDMENT 10

Powers Retained by the States and the People

The powers not delegated to the United States by the Constitution, nor prohibited by it to the states, are reserved to the states respectively, or to the people.

This amendment was adopted to reassure people that the national government would not swallow up the states. It confirms that the states or the people retain all powers not given to the national government. For example, the states have authority over such matters as marriage and divorce. But the Constitution says the federal government can make any laws "necessary and proper" to carry out its specific powers. This rule makes it hard to determine the exact rights of states.

AMENDMENT 11

Lawsuits Against States

This amendment was proposed on March 4, 1794, and ratified on Feb. 7, 1795.

The judicial power of the United States shall not be construed to extend to any suit in law or equity, commenced or prosecuted against one of the United States by citizens of another state, or by citizens or subjects of any foreign state.

This amendment makes it impossible for a citizen of one state to sue another state in federal court. The amendment resulted from the 1793 case of *Chisholm v. Georgia*, in which a man from South Carolina sued the state of Georgia over an inheritance. Georgia argued that it could not be sued in federal court, but the Supreme Court ruled that the state could be. Georgia then led a movement to add this amendment to the Constitution. However, an individual can still sue state authorities in federal court for depriving him of his constitutional rights.

AMENDMENT 12

Election of the President and Vice-President

This amendment was proposed on Dec. 9, 1803, and ratified on July 27, 1804.

The electors shall meet in their respective states and vote by ballot for President and Vice-President, one of whom, at least, shall not be an inhabitant of the same state with themselves; they shall name in their ballots the person voted for as President, and in distinct ballots the person voted for as Vice-President, and they shall make distinct lists of all persons voted for as President, and of all persons voted for as Vice-President, and of the number of votes for each, which lists they shall sign and certify, and transmit sealed to the seat of the government of the United States, directed to the president of the Senate;——the president of the Senate shall, in the presence of the Senate and House of Representatives, open all the certificates and the votes shall then be counted;——the person having the greatest number of votes for President, shall be the President, if such number be a majority of the whole number of electors appointed; and if no person have such majority, then from the persons having the highest numbers not exceeding three on the list of those voted for as President, the House of Representatives shall choose immediately, by ballot, the President. But in choosing the President, the votes shall be taken by states, the representation from each state having one vote; a quorum for this purpose shall consist of a member or members from two-thirds of the states, and a majority of all the states shall be necessary to a choice. And if the House of Representatives shall not choose a President whenever the right of choice shall devolve upon them, [before the fourth day of March next following,] then the Vice-President shall act as President, as in the case of the death or other constitutional disability of the President.——The person having the greatest number of votes as Vice-President, shall be the Vice-President, if such number be a majority of the whole number of electors appointed, and if no person have a majority, then from the two highest numbers on the list, the Senate shall choose the Vice-President; a quorum for the purpose shall consist of two-thirds of the whole number of senators, and a majority of the whole number shall be necessary to a choice. But no person constitutionally ineligible to the office of President shall be eligible to that of Vice-President of the United States.

This amendment provides that members of the Electoral College, called *electors*, vote for one person as President and for another as Vice-President. The amendment resulted from the election of 1800. At that time, each elector voted for two men, not saying which he wanted for President. The man who received the most votes became President, and the runner-up became Vice-President. Thomas Jefferson, the presidential candidate, and Aaron Burr, the vice-presidential candidate, received the same number of votes. The tie threw the election into the House of Representatives. The House chose Jefferson but took so long that people feared it would fail to choose a President before Inauguration Day. The House has chosen one other President—John Quincy Adams in 1825.

AMENDMENT 13

Abolition of Slavery

This amendment was proposed on Jan. 31, 1865, and ratified on Dec. 6, 1865.

Section 1. **Neither slavery nor involuntary servitude, except as a punishment for crime whereof the party shall have been duly convicted, shall exist within the United States, or any place subject to their jurisdiction.**

President Abraham Lincoln's Emancipation Proclamation of 1863 had declared slaves free in the Confederate States still in rebellion. This amendment completed the abolition of slavery in the United States.

Section 2. **Congress shall have power to enforce this article by appropriate legislation.**

AMENDMENT 14

Civil Rights

This amendment was proposed on June 13, 1866, and ratified on July 9, 1868.

Section 1. **All persons born or naturalized in the United States, and subject to the jurisdiction thereof, are citizens of the United States and of the state wherein they reside. No state shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States; nor shall any state deprive any person of life, liberty, or property, without due process of law; nor deny to any person within its jurisdiction the equal protection of the laws.**

The principal purpose of this amendment was to make former slaves citizens of both the United States and the state in which they lived. The amendment also forbids the states to deny equal rights to any person. The terms of the amendment clarify how citizenship is acquired. State citizenship is a by-product of national citizenship. By living in a state, every U.S. citizen automatically becomes a citizen of that state as well. All persons *naturalized* (granted citizenship) according to law are U.S. citizens. Anyone born in the United States is also a citizen regardless of the nationality of his parents, unless they are diplomatic representatives of another country or enemies during a wartime occupation. Such cases are exceptions because the parents are not "subject to the jurisdiction" of the United States. The amendment does not grant citizenship to Indians on reservations, but Congress passed a law that did so.

The phrase "due process of law" forbids the states to violate most rights protected by the Bill of Rights. The statement that a state cannot deny anyone "equal protection of the laws" has provided the basis for many Supreme Court rulings on civil rights. For example, the court has outlawed segregation in public schools. The judges declared that "equal protection" means a state must make sure all children, regardless of race, have an equal opportunity for education.

Section 2. **Representatives shall be apportioned among the several states according to their respective numbers, counting the whole number of persons in each state, [excluding Indians not taxed]. But when the right to vote at any election for the choice of electors for President and Vice-President of the United States, representatives in Congress, the executive and judicial officers of a state, or the members of the legislature thereof, is denied to any of the male inhabitants of such state, being twenty-one years of age, and citizens of the United States, or in any way abridged, except for participation in rebellion, or other crime, the basis of representation therein shall be reduced in the proportion which the number of such male citizens shall bear to the whole number of male citizens twenty-one years of age in such state.**

This section proposes a penalty for states which refuse

to give the vote in federal elections to all adult male citizens. States which restrict voting can have their representation in Congress cut down. This penalty has never been used. The section has been set aside by the 19th and 26th amendments.

Section 3. **No person shall be a senator or representative in Congress, or elector of President and Vice-President, or hold any office, civil or military, under the United States, or under any state, who, having previously taken an oath, as a member of Congress, or as an officer of the United States, or as a member of any state legislature, or as an executive or judicial officer of any state, to support the Constitution of the United States, shall have engaged in insurrection or rebellion against the same, or given aid or comfort to the enemies thereof. But Congress may by a vote of two-thirds of each House, remove such disability.**

This section is of historical interest only. Its purpose was to keep federal officers who joined the Confederacy from becoming federal officers again. Congress could vote to overlook such a record.

Section 4. **The validity of the public debt of the United States, authorized by law, including debts incurred for payment of pensions and bounties for services in suppressing insurrection or rebellion, shall not be questioned. But neither the United States nor any state shall assume or pay any debt or obligation incurred in aid of insurrection or rebellion against the United States, or any claim for the loss or emancipation of any slave; but all such debts, obligations and claims shall be held illegal and void.**

This section ensured that the Union's Civil War debt would be paid, but voided all debts run up by the Confederacy in fighting the war. The section also said that former slave owners would not be paid for slaves who were freed.

Section 5. **The Congress shall have power to enforce, by appropriate legislation, the provisions of this article.**

AMENDMENT 15

Negro Suffrage

This amendment was proposed on Feb. 26, 1869, and ratified on Feb. 3, 1870.

Section 1. **The right of citizens of the United States to vote shall not be denied or abridged by the United States or by any state on account of race, color, or previous condition of servitude.**

Negroes who had been slaves became citizens under the terms of the 14th Amendment. The 15th Amendment does not specifically say that all blacks must be allowed to vote. The states are free to set qualifications for voters. But the amendment says that a voter cannot be denied the ballot because of his race. Some states have attempted to do this indirectly. Such measures have been struck down by Supreme Court decisions, federal and state laws, and the 24th Amendment. See FIFTEENTH AMENDMENT; GRANDFATHER CLAUSE; VOTING.

Section 2. **The Congress shall have power to enforce this article by appropriate legislation.**

AMENDMENT 16

Income Taxes

This amendment was proposed on July 12, 1909, and ratified on Feb. 3, 1913.

The Congress shall have power to lay and collect taxes on incomes, from whatever source derived, without apportionment among the several states, and without regard to any census or enumeration.

In 1894, Congress passed an income tax law, but the Supreme Court declared it unconstitutional. This amendment authorized Congress to levy such a tax.

AMENDMENT 17

Direct Election of Senators

This amendment was proposed on May 13, 1912, and ratified on April 8, 1913.

(1) The Senate of the United States shall be composed of two senators from each state, elected by the people thereof for six years; and each senator shall have one vote. The electors in each state shall have the qualifications requisite for electors of the most numerous branch of the state legislatures.

(2) When vacancies happen in the representation of any state in the Senate, the executive authority of such state shall issue writs of election to fill such vacancies: *Provided*, That the legislature of any state may empower the executive thereof to make temporary appointments until the people fill the vacancies by election as the legislature may direct.

(3) This amendment shall not be so construed as to affect the election or term of any senator chosen before it becomes valid as part of the Constitution.

This amendment takes the power of electing the senators of a state from the state legislature and places it in the hands of the people of the state.

AMENDMENT 18

Prohibition of Liquor

This amendment was proposed on Dec. 18, 1917, and ratified on Jan. 16, 1919.

Section 1. **After one year from the ratification of this article the manufacture, sale, or transportation of intoxicating liquors within, the importation thereof into, or the exportation thereof from the United States and all territory subject to the jurisdiction thereof for beverage purposes is hereby prohibited.**

Section 2. **The Congress and the several states shall have concurrent power to enforce this article by appropriate legislation.**

Section 3. **This article shall be inoperative unless it shall have been ratified as an amendment to the Constitution by the legislatures of the several states, as provided in the Constitution, within seven years from the date of the submission hereof to the states by the Congress.**

This is the prohibition amendment, which forbade people to make, sell, or transport liquor. It was repealed by the 21st Amendment in 1933.

AMENDMENT 19

Woman Suffrage

This amendment was proposed on June 4, 1919, and ratified on Aug. 18, 1920.

Section 1. **The right of citizens of the United States to vote shall not be denied or abridged by the United States or by any state on account of sex.**

Section 2. Congress shall have power to enforce this article by appropriate legislation.

Amendments giving women the right to vote were introduced in Congress one after another for more than 40 years before this one was finally passed.

AMENDMENT 20

Terms of the President and Congress

This amendment was proposed on March 2, 1932, and ratified on Jan. 23, 1933.

Section 1. The terms of the President and Vice-President shall end at noon on the 20th day of January, and the terms of senators and representatives at noon on the third day of January, of the year in which such terms would have ended if this article had not been ratified; and the terms of their successors shall then begin.

Section 2. The Congress shall assemble at least once in every year, and such meeting shall begin at noon on the third day of January, unless they shall by law appoint a different day.

Section 3. If, at the time fixed for the beginning of the term of the President, the President elect shall have died, the Vice-President elect shall become President. If a President shall not have been chosen before the time fixed for the beginning of his term, or if the President elect shall have failed to qualify, then the Vice-President elect shall act as President until a President shall have qualified; and the Congress may by law provide for the case wherein neither a President elect nor a Vice-President elect shall have qualified, declaring who shall then act as President, or the manner in which one who is to act shall be selected, and such person shall act accordingly until a President or Vice-President shall have qualified.

Section 4. The Congress may by law provide for the case of the death of any of the persons from whom the House of Representatives may choose a President whenever the right of choice shall have devolved upon them, and for the case of the death of any of the persons from whom the Senate may choose a Vice-President whenever the right of choice shall have devolved upon them.

Section 5. Sections 1 and 2 shall take effect on the 15th day of October following the ratification of this article.

Section 6. This article shall be inoperative unless it shall have been ratified as an amendment to the Constitution by the legislatures of three-fourths of the several states within seven years from the date of its submission.

This amendment, called the *lame duck amendment*, moves the date that newly elected Presidents and congressmen take office closer to election time. A *lame duck* is an official who continues to serve though not re-elected. Before the amendment came into force, defeated congressmen continued to hold office for four months. See LAME DUCK AMENDMENT.

AMENDMENT 21

Repeal of Prohibition

This amendment was proposed on Feb. 20, 1933, and ratified on Dec. 5, 1933.

Section 1. The eighteenth article of amendment to the Constitution of the United States is hereby repealed.

Section 2. The transportation or importation into any state, territory, or possession of the United States for delivery or use therein of intoxicating liquors, in violation of the laws thereof, is hereby prohibited.

Section 3. This article shall be inoperative unless it shall have been ratified as an amendment to the Constitution by conventions in the several states, as provided in the Constitution, within seven years from the date of the submission hereof to the states by the Congress.

This amendment simply repeals the 18th Amendment. Section 2 promises federal help to "dry" states in enforcing their own prohibition laws.

AMENDMENT 22

Limitation of Presidents to Two Terms

This amendment was proposed on March 24, 1947, and ratified on Feb. 27, 1951.

Section 1. No person shall be elected to the office of the President more than twice, and no person who has held the office of President, or acted as President, for more than two years of a term to which some other person was elected President shall be elected to the office of the President more than once. But this article shall not apply to any person holding the office of President when this article was proposed by the Congress, and shall not prevent any person who may be holding the office of President, or acting as President, during the term within which this article becomes operative from holding the office of President or acting as President during the remainder of such term.

Section 2. This article shall be inoperative unless it shall have been ratified as an amendment to the Constitution by the legislatures of three-fourths of the several states within seven years from the day of its submission to the states by the Congress.

This amendment provides that no person can be elected President more than twice. Nobody who has served as President for more than two years of someone else's term can be elected more than once. One President can hold office for no more than 10 years. The amendment was supported by people who thought President Franklin D. Roosevelt should not serve four terms. No other President has run for election more than twice.

AMENDMENT 23

Suffrage in the District of Columbia

This amendment was proposed on June 16, 1960, and ratified on March 29, 1961.

Section 1. The district constituting the seat of government of the United States shall appoint in such manner as the Congress may direct: A number of electors of President and Vice-President equal to the whole number of senators and representatives in Congress to which the district would be entitled if it were a state, but in no event more than the least populous state; they shall be in addition to those appointed by the states, but they shall be considered, for the purposes of the election of President and Vice-President, to be electors appointed by a state; and they shall meet in the district and perform such duties as provided by the twelfth article of amendment.

Section 2. The Congress shall have power to enforce this article by appropriate legislation.

This amendment allows citizens of the District of Columbia to vote in presidential elections. However, they cannot vote for members of Congress.

AMENDMENT 24

Poll Taxes

This amendment was proposed on Aug. 27, 1962, and ratified on Jan. 23, 1964.

Section 1. **The right of citizens of the United States to vote in any primary or other election for President or Vice-President, for electors for President or Vice-President, or for senator or representative in Congress, shall not be denied or abridged by the United States or any state by reason of failure to pay any poll tax or other tax.**

Section 2. **The Congress shall have power to enforce this article by appropriate legislation.**

This amendment forbids making voters pay a *poll tax* before they can vote in a national election. A poll tax, also called a *head tax*, is a tax collected equally from everyone. Some states once used such taxes to keep poor people and blacks from voting. The term *poll tax* does not mean a tax on voting. It comes from the old English word *poll*, meaning *head*. See POLL TAX.

AMENDMENT 25

Presidential Disability and Succession

This amendment was proposed on July 6, 1965, and ratified on Feb. 10, 1967.

Section 1. **In case of the removal of the President from office or of his death or resignation, the Vice-President shall become President.**

Section 2. **Whenever there is a vacancy in the office of the Vice-President, the President shall nominate a Vice-President who shall take office upon confirmation by a majority vote of both houses of Congress.**

This section provides for filling a vacancy in the vice-presidency. In 1973, Gerald R. Ford became the first person ever chosen Vice-President under the terms of the amendment. He was nominated by President Richard M. Nixon after Vice-President Spiro T. Agnew resigned. In 1974, Nixon resigned and Ford became President. Nelson A. Rockefeller then became Vice-President under the new procedure. For the first time, the United States had both a President and Vice-President who had not been elected to their office. Before this amendment came into force, vacancies in the vice-presidency remained unfilled until the next presidential election.

Section 3. **Whenever the President transmits to the president pro tempore of the Senate and the speaker of the House of Representatives his written declaration that he is unable to discharge the powers and duties of his office, and until he transmits to them a written declaration to the contrary, such powers and duties shall be discharged by the Vice-President as acting President.**

This section provides that the Vice-President succeeds to the presidency if the President becomes disabled.

Section 4. **Whenever the Vice-President and a majority of either the principal officers of the executive departments or of such other body as Congress may by law provide, transmit to the president pro tempore of the Senate and the speaker of the House of Representatives their written declaration that the President is unable to discharge the powers and duties of his office, the Vice-President shall immediately assume the powers and duties of the office as acting President.**

Thereafter, when the President transmits to the president pro tempore of the Senate and the speaker of the House of Representatives his written declaration that no inability exists, he shall resume the powers and duties of his office unless the Vice-President and a majority of either the principal officers of the executive department or of such other body as Congress may by law provide, transmit within four days to the president pro tempore of the Senate and the speaker of the House of Representatives their written declaration that the President is unable to discharge the powers and duties of his office. Thereupon Congress shall decide the issue, assembling within forty-eight hours for that purpose if not in session. If the Congress, within twenty-one days after receipt of the latter written declaration, or, if Congress is not in session, within twenty-one days after Congress is required to assemble, determines by two-thirds vote of both houses that the President is unable to discharge the powers and duties of his office, the Vice-President shall continue to discharge the same as acting President; otherwise, the President shall resume the powers and duties of his office.

AMENDMENT 26

Suffrage for 18-Year-Olds

This amendment was proposed on March 23, 1971, and ratified on July 1, 1971.

Section 1. **The right of citizens of the United States, who are eighteen years of age or older, to vote shall not be denied or abridged by the United States or by any state on account of age.**

Section 2. **The Congress shall have power to enforce this article by appropriate legislation.**

This amendment grants the vote to citizens 18 years of age or older.

Annotations by J. W. PELTASON

CONSTITUTION STATE. See CONNECTICUT.

CONSTITUTIONAL CONVENTION. See CONSTITUTION OF THE UNITED STATES (The Constitutional Convention).

CONSTITUTIONAL UNION PARTY was an American political party formed in 1859 by former members of the Whig and Know-Nothing parties. At a convention in Baltimore in 1860, the party nominated John Bell and Edward Everett for President and Vice-President. A platform of national unity was adopted. The candidates lost, and the party died out.

DAVID HERBERT DONALD

See also WHIG; BELL, JOHN.

CONSTITUTIONALISM. See POLITICAL SCIENCE (Constitutionalism).

CONSTRUCTION, BUILDING. See BUILDING CONSTRUCTION.

CONSTRUCTION BATTALION. See SEABEES.

CONSTRUCTION ENGINEER. See ENGINEERING (Engineers at Work).

CONSUL, *KAHN suhl*, is an official appointed by the government of one country to look after its commercial interests in a city of another country. A consul differs from a diplomatic representative in that he attends primarily to business matters, while the diplomat is inter-

ested primarily in political relations (see AMBASSADOR). United States consuls issue birth, death, and marriage certificates to Americans temporarily within their jurisdiction, regulate shipping, and insure justice to American citizens who are traveling abroad.

The Consular Service of any leading country is divided into three ranks: consuls-general, consuls, and commercial agents. The consuls-general have charge of all consuls in a district. The commercial agents, although they have the same duties and powers as consuls, are not officially recognized by the government. The powers and duties of consuls are often determined by treaty.

Roman Consul. The title *consul* was given to the two highest magistrates of the Roman republic. The insignia were the purple-bordered toga, a staff of ivory, and an ornamental chair. The title, without the function, was retained under the empire.

During the French Republic, from 1799 to 1804, the three chief magistrates were consuls. Napoleon Bonaparte, the first consul, held all the real power in the government. PAYSON S. WILD

See also LICTOR.

CONSULATE. See NAPOLEON I (First Consul).

CONSULTING ENGINEER. See ENGINEERING (Engineers at Work).

CONSUMER AFFAIRS, OFFICE OF, is an agency of the United States government. It analyzes and coordinates all government activities in the field of consumer protection. The office serves chiefly in an advisory and informational role. It does not have the authority to enforce specific laws that protect consumers.

The Office of Consumer Affairs provides a central point within the government for receiving complaints of consumers. It has no power to resolve complaints, but it gives them to the appropriate government agency.

President Richard M. Nixon created the office in 1971. It succeeded the President's Committee on Consumer Interests, which President Lyndon B. Johnson had created in 1964. In 1973, the office was transferred from the Executive Office of the President to the Department of Health, Education, and Welfare. The director of the agency also serves the President as Special Assistant for Consumer Affairs and advises him on matters affecting consumers. ROBERT O. HERRMANN

See also CONSUMER PROTECTION.

CONSUMER AND MARKETING SERVICE. See AGRICULTURAL MARKETING SERVICE.

CONSUMER COOPERATIVE. See COOPERATIVE.

CONSUMER CREDIT. See CREDIT; INSTALLMENT PLAN.

CONSUMER PRICE INDEX. See COST OF LIVING.

CONSUMER PRODUCT SAFETY COMMISSION is an independent agency of the United States government. It works to protect consumers from unsafe products that can cause illness, injury, or even death.

The commission promotes the enactment of uniform federal and state safety laws for products. It also establishes and enforces federal safety standards for the content, construction, and performance of more than 10,000 manufactured goods. It regulates a wide variety of products, including appliances, baby clothes, gardening tools, sports equipment, and toys. The commission does not deal with such products as cosmetics, drugs, and food, which are regulated by other agencies. But it regulates the packaging of some of these products to ensure that children cannot open them too easily.

The commission can order the recall, repair, or replacement of products that it considers hazardous. It has the authority to seize especially dangerous products or to forbid their sale. The agency conducts research on the causes and prevention of accidents associated with consumer products. It also carries on programs to help educate the public about product safety.

Congress created the commission in 1972. The President appoints the five members of the agency to seven-year terms, subject to the approval of the Senate.

Critically reviewed by CONSUMER PRODUCT SAFETY COMMISSION

CONSUMER PROTECTION, also called CONSUMERISM, refers to efforts by governments and private groups and individuals to promote the interests of the buying public. These efforts are aimed at protecting consumers from impure food and drugs, unsafe manufactured goods, and fraudulent advertising and trade practices. Consumer protection also is related to efforts to rid the environment of the harmful effects of the manufacture or use of some products.

Some kinds of consumer protection have been going on for hundreds of years. For example, the guilds established by craftsmen during the Middle Ages set standards for goods sold by members. But until the early 1900's, governments did little to protect consumers.

In the United States, many federal, state, and local agencies and laws are designed to protect the consumer. Companies sponsor better business bureaus and chambers of commerce that work to safeguard the public from unfair business practices. In addition, schools and consumer groups help educate and protect consumers.

This article deals with consumer protection in the United States. The situation is similar in Canada, Great Britain, and other industrialized countries.

Development of Consumer Protection. Until the mid-1800's, consumers in the United States bought most of their goods from local shopkeepers or craftsmen. If they were dissatisfied with the price, quality, or service, they could deal directly with the person who made or sold the product. There was little or no demand for government protection of consumers. But products—and the methods of producing and merchandising them—continually became more complex. Consumers found it increasingly difficult to know everything they should have known about the products. A wrong choice could lead to tragedy. For example, impure food or drugs could cause serious illness or even death.

Large-scale regulation of private business to protect the public started in the late 1800's. The rise of business monopolies during the 1800's had convinced Congress that government regulation was necessary. The monopolies lacked competition from other companies, and so they could regulate the supply of goods and set high prices for their products. They also could market a product of low quality without losing sales. In the late 1800's, Congress passed a series of antimonopoly laws. One of the first such laws established the Interstate Commerce Commission to regulate interstate transportation companies in the public interest.

Public interest in consumer protection grew slowly at first. But in the 1960's and early 1970's, consumerism gained wide acceptance and support.

CONSUMER PROTECTION

Government Protection of consumer interests in the United States is provided at the federal, state, and local levels.

Federal Services. Many federal agencies administer consumer protection laws. The Federal Trade Commission promotes free and fair competition, investigates false and deceptive advertising, and enforces truthful labeling of textile and fur products. The Food and Drug Administration enforces federal laws concerning the purity and truthful labeling of food, drugs, and cosmetics. The Interstate Commerce Commission regulates rates and trade practices of interstate transportation companies. The Civil Aeronautics Board and the Federal Aviation Administration regulate the air transport industry. The Federal Power Commission controls the transmission and sale of electricity and natural gas. The Securities and Exchange Commission works to prevent fraud in the sale of stocks and bonds. The Drug Enforcement Administration fights the illegal sale and use of narcotics and other drugs. The National Highway Safety Bureau sets motor vehicle safety standards. The Environmental Protection Agency establishes and enforces environmental standards and may cancel federal approval of certain products that endanger public health. The Consumer Product Safety Commission establishes and enforces safety standards for consumer products not covered by other agencies.

Other federal laws and activities also benefit consumers. The Consumer Credit Protection Act of 1968, often called the Truth in Lending Act, protects persons who borrow money and buy on credit. It requires businessmen to state the charges for loans and installment purchases in terms of the true annual interest rate. The Department of Agriculture sets inspection and labeling standards for dairy products, eggs, meat, and other foods. The Postal Service tries to prevent the mails from being used to promote fraudulent schemes. The Department of Justice prosecutes violators of consumer protection laws. The Office of Consumer Affairs in the Department of Health, Education, and Welfare coordinates federal consumer interests.

State and Local Agencies. All the states have some consumer protection laws, and over half have a consumer affairs agency. In 1957, New York established the first statewide consumer protection agency. Many large cities have consumer protection offices.

Consumer Crusaders. Crusading by individuals has led to the passage of a number of consumer protection laws. Upton Sinclair exposed the careless and filthy conditions in the meat-packing industry in his novel *The Jungle* (1906). This book helped bring about passage of the Federal Food and Drugs Act of 1906. In the 1950's, Senator Estes Kefauver of Tennessee led a movement to update the nation's drug laws.

The consumer movement gained widespread acceptance during the 1960's. Rachel Carson attacked the irresponsible use of pesticides in her book *Silent Spring* (1962). Her work inspired many other persons to oppose the sale and use of products that pollute the environment and endanger human health. Ralph Nader became a leading consumer crusader in the 1960's. His book *Unsafe at Any Speed* (1965) convinced the public and Congress that many types of cars were unsafe. This book led to passage of the National Traffic and Motor Vehicle Safety Act of 1966. Nader also opposed many other business and government practices that he felt endangered public health and safety.

Consumer Education is one of the most important aspects of consumer protection. A well-informed public can be the best defense against unscrupulous sales practices. Each year, the federal government publishes consumer information on hundreds of subjects. Many schools offer courses in consumer education. In 1968, Illinois became the first state to require all public high schools to offer programs that include concepts in consumer education. The federal government provides funds for consumer education as a part of home economics courses in public schools.

Consumer organizations also contribute to consumer education. Consumers Union and Consumers' Research, Inc., test a wide variety of products and publish the results. These organizations are financed entirely by consumers. In addition, consumer organizations lobby for consumer legislation and advise the buying public on where to get help for specific problems. LEONARD S. SILK

Related Articles. Most of the federal agencies discussed in this article have separate articles in WORLD BOOK. See also the following articles:

Better Business Bureau
Carson, Rachel
Clothing (Protecting the Public)
Consumption
Meat Packing (U.S. Government Inspection)
Monopoly and Competition
Nader, Ralph
Packaging
Pure Food and Drug Laws
Sinclair, Upton
Textile (Testing Fabrics; Textile Regulations)
Trademark

CONSUMERISM. See CONSUMER PROTECTION.

CONSUMERS LEAGUE, NATIONAL. See NATIONAL CONSUMERS LEAGUE.

CONSUMERS UNION OF THE UNITED STATES is an independent, nonprofit organization that tests and rates various brands of products. These products include appliances, automobiles, and food products. Consumers Union publishes reports on the tests in its monthly magazine, *Consumer Reports.* Each issue also includes articles designed to help consumers spend wisely and to inform them about consumer problems.

Consumers Union also fights for increased consumer protection. It calls attention to what it considers unsafe products, failures by government regulatory agencies, and weaknesses in laws.

Consumers Union was established in 1936, when it split off from Consumers' Research, Inc., the first product-testing organization supported by consumers. The consumer members of Consumers Union elect its board of directors. ROBERT O. HERRMANN

CONSUMPTION, a disease. See TUBERCULOSIS.

CONSUMPTION, *kuhn SUHMP shuhn,* in economics, is the use of goods and services to satisfy needs and desires. Most business activity is aimed at providing goods and services for consumption. Examples of consumption include eating food, wearing clothing, and using soap. People who use goods and services are called *consumers.*

The amount of goods and services that a family consumes depends almost entirely on its income. After taxes are deducted, Americans spend over 90 per cent of their yearly incomes on consumer goods and services.

Families with low incomes tend to spend a larger part of their earnings for essentials such as food and housing

than do families with higher incomes. Those with the lowest incomes spend more than they earn and are forced into debt. As incomes rise, families tend to spend a larger part of their earnings for such items as clothing, education, and entertainment. John Maynard Keynes, a noted British economist, was one of the first to emphasize the close relationship between income and consumption (see KEYNES, JOHN MAYNARD).

About two-thirds of all the goods and services produced in the United States each year are used by consumers. The remaining third is used by the government or invested in buildings, manufacturing machinery, and other forms of capital. In Great Britain, consumers also use about two-thirds of the goods and services produced. In the Soviet Union, only slightly over half of the country's goods and services are consumed. ROBERT DORFMAN

Related Articles in WORLD BOOK include:

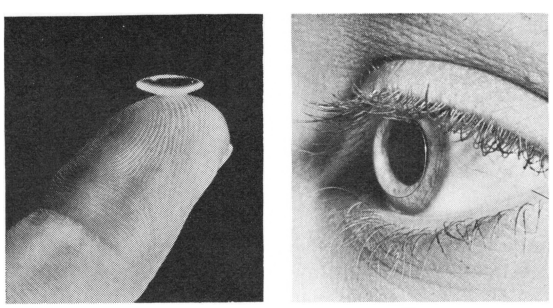
Consumer Protection
Distribution
Economics (The Consumer is "Boss")
Income
Production
Standard of Living

CONTACT FLYING. See NAVIGATION (Piloting).

CONTACT LENS is a plastic eyeglass that is worn directly on the eye. Most contact lenses are about the size of a person's little fingernail. They float on a thin layer of tears on the surface of the *cornea*. The cornea is the clear part of the eyeball in front of the pupil.

Contact lenses cost more than ordinary glasses, but they have certain advantages over ordinary glasses. They do not need to be changed nearly as often. A person's eyelids keep contact lenses from fogging over in cold weather. Ordinary glasses reduce the size of objects that very nearsighted persons see, and distort their side vision. Most contact lenses produce normal-sized images and leave side vision unimpaired. Most contact lenses also produce normal vision in persons who have *keratoconus*. Keratoconus causes the cornea of the eye to bulge out at its center, creating blurred images that ordinary glasses cannot correct. Persons who have had cataracts removed can see much better with contact lenses than with ordinary glasses (see CATARACT).

However, most persons wear contact lenses because they believe ordinary glasses harm their appearance. It is difficult to tell when a person is wearing contact lenses. For this reason, many actors, actresses, and others in public life who need to present a pleasing appearance wear them. Athletes may also wear them to avoid injuries they might get wearing glasses.



Plastic Contact Lens Co.

Contact Lenses float on the eye's natural tear layer, *above right*. Balanced on the tip of a finger, *above left*, the lenses can be placed on the eye.

Present-day contact lenses are more comfortable and can be worn for much longer periods of time than earlier types. Earlier types were made of glass about the size of a quarter and were molded to fit the white part of the eye as well as the cornea. Persons who wore them used a special fluid between the lens and the eye. In 1971, soft contact lenses made of a porous liquid-absorbing plastic became available. These lenses are especially comfortable because they are as soft and flexible as the eye tissues. But they are more expensive than stable contact lenses and require special sterilization procedures. Persons who wear contact lenses should have regular examinations to make sure the lenses are not damaging their eyes. JOHN R. MCWILLIAMS

CONTAGIOUS DISEASE. See DISEASE (introduction; How Diseases Spread).

CONTAINERIZATION is a method of shipping freight by placing it into large containers. Containerization helps prevent damage to the freight. It also reduces the time and cost required to load the freight onto—and unload it from—a vehicle.

Most shipping containers are made of aluminum, steel, fiberglass, or plywood and can be easily transported by airplane, ship, railroad, or truck. An *intermodal* container can be used to transport freight by two or more kinds of vehicles—by train and ship, for example, or by truck and plane. Most containers are reusable. The size of a shipping container depends on the vehicle used. The largest containers are carried by ship or railroad. Most of these containers range from 20 to 40 feet (6 to 12 meters) long and measure 8 feet (2.4 meters) wide and 8 feet high. Most containers carried by air are smaller.

Containerization developed in the mid-1950's. *Piggybacking*, the transporting of truck trailers on railroad flatcars, was the first widely used method of container shipping. GLENN MATHER

See also SHIP (Container Ships); RAILROAD (Freight Services); TRANSPORTATION (Transportation Today).

CONTAINMENT POLICY. See COLD WAR (The Containment Policy).

CONTAMINATION. See POLLUTION.

CONTÉ, NICOLAS. See PENCIL (History).

CONTEMPT, in law, is willful disregard or disobedience of public authority, such as a court or legislative assembly. Contempt is usually shown by failure to obey specific demands, or by insults. There are two kinds of contempt of court: those committed in the presence of the court, which disturb or interrupt its proceedings, and those that result from a refusal to comply with an order of the court. Both are punishable by fine or imprisonment. See also ATTACHMENT. FRED E. INBAU

CONTINENT is a part of the earth's surface that forms one of the great dry-land masses of the world. It usually has extensive plains or plateaus and one or more mountain ranges, and is surrounded or nearly surrounded by water. The continents of the world are Asia (16,966,000 square miles, or 43,942,000 square kilometers); Africa (11,707,000 square miles, or 30,320,000 square kilometers); North America (9,417,000 square miles, or 24,390,000 square kilometers); South America (6,884,000 square miles, or 17,829,000 square kilometers); Antarctica (5,100,000 square miles, or 13,209,000 square

kilometers); Europe (4,063,000 square miles, or 10,523,000 square kilometers); and Australia (2,968,000 square miles, or 7,687,000 square kilometers). Technically, Europe is not a continent, but a peninsula of Asia. It is part of what may be called the Eurasian continent, with a total area of 21,029,000 square miles (54,465,000 square kilometers). See also the articles in WORLD BOOK for each continent. J. ROWLAND ILLICK

CONTINENTAL, a type of paper money. See MONEY (New Nation, New Currency).

CONTINENTAL ARMY. See ARMY, U.S. (History).

CONTINENTAL ASSOCIATION was an agreement adopted by the First Continental Congress on Oct. 20, 1774. It provided that each colony would (1) stop all importing from Great Britain by Dec. 1, 1774; (2) discontinue the slave trade effective Dec. 1, 1774; (3) stop consumption of all British and some foreign products by Mar. 1, 1775; and (4) stop all exports to Britain and the West Indies by Sept. 10, 1775. The association was operating in 12 colonies by April, 1775.

CONTINENTAL CODE. See MORSE CODE.

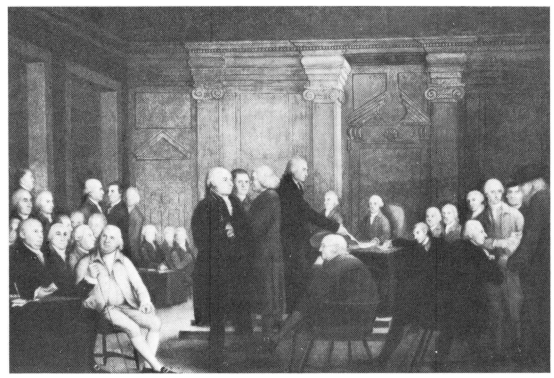
CONTINENTAL CONGRESS was a convention of delegates from the American Colonies that first met in Philadelphia on Sept. 5, 1774. The meeting grew out of a desire for unity which had spread through the colonies. All the colonies saw danger to themselves in the acts of Parliament aimed against Massachusetts, especially the Boston Port Bill. See BOSTON PORT BILL.

The First Continental Congress was attended by 56 delegates representing 12 colonies. Georgia sent no delegates but agreed to support any plans made at the meeting. Leaders of the Congress included Samuel Adams, George Washington, Peyton Randolph, Patrick Henry, Richard Henry Lee, John Adams, John Jay, Joseph Galloway, and John Dickinson. Peyton Randolph of Virginia was chosen president of the Congress, and each of the 12 colonies had equal voting power.

The first Congress was more interested in fair treatment from Great Britain than in independence. It set forth the position of the colonies toward taxation and trade in a Declaration of Rights, adopted on Oct. 14, 1774. The Congress recognized that it was not practical for the colonies to seek representation in Parliament. But it claimed the right of each colonial assembly to draw up its laws on all subjects except foreign trade.

Probably the boldest act of the Congress was to set up the Continental Association, which bound the colonists not to trade with Great Britain or use British goods until British trade and taxation policies had been changed. The delegates made plans to hold another Congress the following May, if necessary.

Second Continental Congress. British colonial policy did not change, and the colonies drew close to war with the fighting between Massachusetts farmers and English troops at Lexington and Concord. The Second Continental Congress met in Philadelphia on May 10, 1775. New delegates of note were Benjamin Franklin, Thomas Jefferson, and John Hancock. The Congress took on the duties of a government, uniting the colonies for the war effort. An army was organized and George Washington was appointed commander in chief. On July 8, 1775, the Congress issued a declaration setting forth the need to take up arms and the reasons for doing so. Two days later, it made a final, futile appeal to the king in an effort to right matters without going to war.



Oil painting on canvas (about 1789) by Robert E. Pine and Edward Savage; Historical Society of Pennsylvania, Philadelphia

The Second Continental Congress adopted the Declaration of Independence on July 4, 1776. This painting shows members of the Congress voting in Independence Hall in Philadelphia.

With the outbreak of war, the Second Continental Congress encouraged the colonies to set themselves up as states. On July 4, 1776, it adopted the Declaration of Independence. Then it set about drawing up an outline for a permanent union of states which resulted in the Articles of Confederation. The second Congress operated under great difficulties, because it was a group without legal authority except when it acted with the consent of the states. It continued to work until March 1, 1781, when a Congress authorized by the Articles of Confederation took over. This Congress was known as the *Congress of the Confederation*, but many persons continued to use the name Continental Congress for it.

In addition to Peyton Randolph, who served as president twice, the presidents of the Continental Congress were: Henry Middleton, John Hancock, Henry Laurens, John Jay, Samuel Huntington, Thomas McKean, John Hanson, Elias Boudinot, Thomas Mifflin, Richard Henry Lee, Nathaniel Gorham, Arthur St. Clair, and Cyrus Griffin. JOHN R. ALDEN

See also ARTICLES OF CONFEDERATION; CONGRESS OF THE CONFEDERATION; CONTINENTAL ASSOCIATION; DECLARATION OF INDEPENDENCE.

CONTINENTAL DEPOSIT. See OCEAN (The Land Beneath the Sea).

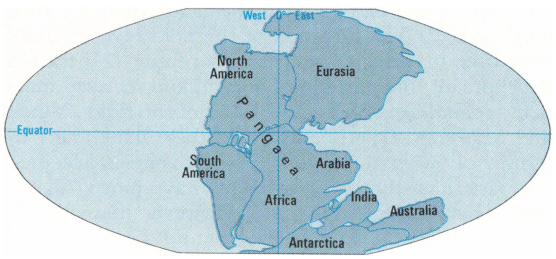
CONTINENTAL DIVIDE is the term used to designate the line separating areas drained to opposite sides of a continent. In North America it is also called the *Great Divide*, and separates westward-flowing and eastward-flowing waters (see GREAT DIVIDE). In South America, the continental divide follows the western portion of the Andes Mountains. In Europe, the divide separates streams flowing to the Atlantic and Arctic oceans on the north and to the Mediterranean and Black seas on the south. In Asia, the term is applied to the separation between drainage into the Arctic and Pacific oceans on the north and east and drainage into the Indian Ocean on the south. The African divide separates the drainage into the Atlantic Ocean from the drainage into the Indian Ocean. E. WILLARD MILLER

See also DIVIDE (diagram; picture).

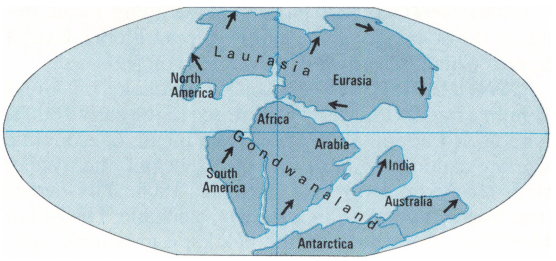
THE DRIFTING CONTINENTS

The three maps below illustrate the theory of continental drift. The top map shows a single land mass—*Pangaea*—about 200 million years ago. The middle map shows Pangaea broken into the land masses *Laurasia* and *Gondwanaland*, and the present continents taking shape. The arrows show the direction in which the continents moved. The bottom map shows the continents today and where they may drift during the next 50 million years, *black outlines*.

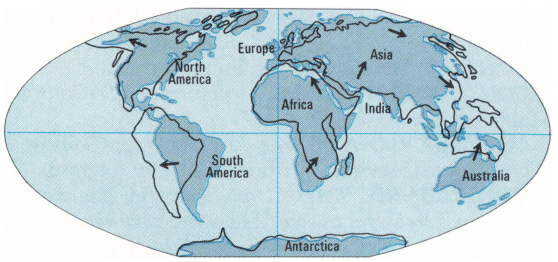
Pangaea: The Supercontinent 200 Million Years Ago



The Land Masses After 65 Million Years of Drift



The Continents Today and 50 Million Years From Now



WORLD BOOK maps adapted from *The Breakup of Pangaea* by R. S. Dietz and J. C. Holden. Copyright © 1970 by Scientific American, Inc. All rights reserved.

CONTINENTAL DRIFT

CONTINENTAL DRIFT is the name of the theory that says the continents have moved great distances on the earth's surface and are still moving today. According to this theory, the continents once formed part of a single land mass called *Pangaea*.

Although much of the earth's land now lies in the Northern Hemisphere, half of Pangaea was in the Southern Hemisphere. What is now the United States lay near the equator, perhaps far east of its present position. India—which at that time was not part of Asia—lay near the South Pole.

About 200 million years ago, according to the theory, Pangaea began to break up into two large land masses called *Gondwanaland* and *Laurasia*. These masses started to break up into the continents, which then began to drift toward their present locations. Some of the continents moved in straight paths, but others rotated. Most of them drifted only about 1 inch (2.5 centimeters) a year. But India may have moved an average of 2 inches (5 centimeters) a year.

Earth scientists have used the theory of continental drift to predict what the earth's surface will look like millions of years from now. They believe that the California coast may tear away from the mainland and drift north toward Alaska. Africa and South America may move farther apart, enlarging the Atlantic Ocean. Australia, drifting north, may collide with Asia.

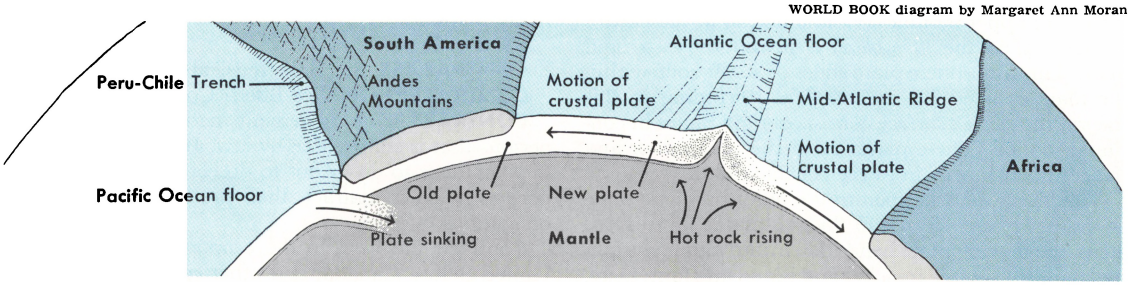
Evidence for the Theory. The German meteorologist Alfred Wegener is considered the father of the continental drift theory. He introduced his theory of drift in 1912. Wegener proposed the name Pangaea for a former supercontinent in 1915. He showed that tropical plants once grew in Greenland and that glaciers once covered the equatorial regions of Africa and Brazil. Wegener believed that movement of the continents caused such changes in climate. But other scientists rejected his theory. They objected chiefly that no one could explain how continents could move such great distances.

During the early and mid-1900's, earth scientists gathered information that supported the continental drift theory. Geologic studies of ancient mountain systems show a connection between the continents. These studies suggest that the Appalachian Mountains of the Eastern United States extend through Newfoundland. The Appalachians may have been connected to the Caledonian mountain system, which runs through

THE CONTINENTAL DRIFT THEORY

The continents drift because the earth's crust consists of large, rigid plates in continual motion. This diagram shows how hot rock rising beneath the Mid-Atlantic Ridge adds material to the plates of South America and Africa. Where two plates meet, the old material is either pulled down into the earth's mantle or pushed up to form mountains. The Peru-Chile Trench and the Andes Mountains were formed by the South American plate and a Pacific Ocean plate.

WORLD BOOK diagram by Margaret Ann Moran



Northern Ireland, Scandinavia, and Scotland. Other evidence for such a connection comes from *paleontologists* (scientists who study fossils). They have found fossils of similar land mammals in 100-million-year-old rocks of Asia, Europe, and North America. It seems unlikely that similar animals could develop on widely separated continents. In the mid-1960's, scientists using radioactive methods for dating rocks found specimens of the same age and type in Africa and South America.

During the 1950's, *paleomagnetism* (the study of magnetism in ancient rocks) helped support the idea of continental drift. Using the magnetic properties of rocks, the British geophysicist S. K. Runcorn located the earth's magnetic poles at the time the rock formed. When rock is hot and liquid, magnetic particles in it are free to point toward the magnetic poles like tiny compass needles. But after the rock cools and hardens, the particles stay pointed in the direction of the pole when the rock cooled. Runcorn found that the positions of the poles determined from European rocks differed from those determined from North American rocks. The difference matched the width of the Atlantic Ocean. Runcorn's studies indicated that the two continents were connected before the ocean formed between them.

Causes of Continental Drift. In spite of all the evidence that the continents had moved, scientists could not explain until the 1960's how they moved. The answer was closely related to an idea proposed 30 years earlier by the Scottish geologist Arthur Holmes. He noted that hot rock rose from deep within the earth's *mantle*, the layer beneath the crust. As the rock neared the surface, it cooled and sank back into the mantle. Holmes suggested that these circulating movements, called *convection currents*, could cause continental drift.

Oceanographers added an important clue to the answer. By the middle 1950's, they had mapped a worldwide system of deep oceanic trenches, *island arcs* (curved chains of islands), and mid-oceanic ridges or mountains. *Seismologists* (scientists who study earthquakes) noted that many deep earthquakes occur beneath oceanic trenches. They also observed that volcanic activity is concentrated along the ocean ridges.

In 1961 and 1962, two American scientists, the geologist H. H. Hess and the oceanographer Robert Dietz, developed the idea of *sea-floor spreading* to explain how continents moved. Working independently, they suggested that convection currents carry molten rock up to the oceanic ridges and force it into large cracks in the ridges. As the molten rock hardens, it pushes the ocean floor and the continents away from the ridges.

Earth scientists believe the movement involves more than just the ocean floor and the continents. They think the entire upper 60 miles (97 kilometers) of the earth's surface, called the *lithosphere*, is in motion as a rigid plate. This lithosphere plate slides on a soft zone within the mantle called the *asthenosphere*. According to this theory, the earth's surface consists of rigid plates in continual motion. These plates carry the ocean floor and the continents away from the oceanic ridges.

Something must happen to the old lithosphere plate as the newly created ocean floor displaces it. In some areas, the moving plate bends downward and melts into the mantle. Oceanic trenches and island arcs form there. In other areas, the edge of the plate crumples and forms large mountain ranges. The study of all such changes in the earth's surface is called *tectonics* (see TECTONICS).

In 1963, the British geophysicists F. J. Vine and D. H. Mathews used paleomagnetic measurements near the oceanic ridges to prove the sea-floor spreading theory. They based their experiments on two facts. (1) Magnetic particles in the sea-floor rocks recorded the direction of the earth's magnetic field when the rock hardened. (2) The direction of the field reversed itself from time to time as the ocean floor formed. If the sea floor spreads, the patterns of normal and reversed magnetism should match on both sides of the ridge. Vine's and Mathews' experiments found these matching patterns. Following their work, many scientists accepted the basic idea that the continents have moved in the past as part of large rigid plates. However, many details of the continental drift theory have not been accepted by scientists. One problem is the lack of proof that convection currents exist and that they provide the energy which moves the continents. ALBERT J. RUDMAN

CONTINENTAL SHELF. See OCEAN (The Land Beneath the Sea; map: The Atlantic Ocean Floor); EARTH (map: Where Oceans Overflow the Land).

CONTINENTAL SYSTEM sought to choke off Great Britain's trade with the rest of Europe in the early 1800's. Napoleon I adopted the system as a means of economic warfare against Britain. Napoleon began the system with his Berlin Decree of Nov. 21, 1806. The decree declared Britain to be in a state of blockade. His Milan Decree of 1807 extended the blockade to neutral ships that stopped in Britain. Napoleon fought the Peninsular War in a vain effort to enforce the system. But these attempts proved to be a major factor in his losing Russia as an ally. See also NAPOLEON I (Dominates Europe). ROBERT B. HOLTMAN

CONTINO, ANTONIO. See BRIDGE OF SIGHS.

CONTOUR MAP. See MAP (pictures: How Contour Maps Are Made).

CONTOUR PLOWING. See AGRICULTURE (Soils and Water); CONSERVATION (pictures); EROSION (picture).

CONTRABAND, *KAHN truh band*, in commerce, means *trade forbidden by law*. The word *contraband* most often refers to goods useful in war, such as arms or ammunition. The warships of a country at war may search for, seize, and destroy contraband goods that are being shipped to its enemy in neutral ships.

In modern total warfare, almost anything is "useful for military purposes" and may be declared contraband. During World War I, Great Britain declared cotton to be contraband, because Germany used it in the manufacture of explosives. During World War II, Germany and Great Britain each published contraband lists of many items. TELFORD TAYLOR

See also BLOCKADE.

CONTRABASS. See BASS (musical instrument).

CONTRACEPTION. See BIRTH CONTROL.

CONTRACT is an agreement made by two or more persons that is enforceable by law. It consists of voluntary promises to do or not to do certain things. When persons make a contract, their promises become legal obligations.

Contracts are vital to the economic systems of the United States, Canada, and other countries where pri-

vate enterprise is encouraged. Much of the wealth of free enterprise nations takes the form of such contracts as bonds and promissory notes. Most business activities in these countries depend on contracts. These contracts include promises to deliver or pay for goods, perform or pay for services, pay wages or rent, exchange real estate, and construct buildings.

Freely made economic decisions are basic elements of the free enterprise system. As a result, a leading principle of contract law is that persons may agree with each other on any terms they think fit. But an agreement that would upset public order is unenforceable. For example, the courts would not enforce an agreement to bribe a public official. The courts also refuse to enforce an agreement if one party has clearly taken unfair advantage of another. The laws bar some persons, chiefly minors or the mentally incompetent, from assuming obligations under contract.

The making of a contract usually involves two important acts: (1) making an offer and (2) accepting the offer. The acts may be verbal or in writing. However, the law requires certain contracts to be made in writing. These include agreements to sell real estate and agreements that cover a long period of time.

Before a contract is formed, the parties usually negotiate the terms of the agreement. One party makes one or several offers. As soon as the other party accepts an offer, the negotiations are over. Under United States law, the moment of acceptance is decisive. At that time, the contract is concluded. Government agencies usually negotiate contracts under special rules. They invite all interested parties to submit *bids* (offers). Then they accept the most favorable bid.

Most contracts are enforceable only if all parties get something out of the agreement. What a contracting party gets is called a *consideration*. When a loan contract is made, the money advanced by the lender is the consideration received by the borrower. The borrower's promise to return the money with interest is the consideration received by the lender. A promise for no consideration is not an offer to make a contract. For example, if two friends promise each other to meet for lunch, no consideration is involved. They merely agree to a social engagement, not to a contract.

A contract is said to be *discharged* after the obligations of the agreement have been fulfilled. If either party violates the agreement, a *breach of contract* occurs. In that case, a court ordinarily awards money, called *damages*, to the other party. In enforcing contracts, the courts try to carry out the plain intention of the agreement. W. F. Young, Jr.

See also Bona Fide; Bond; Lease.

CONTRACT BRIDGE. See Bridge (card game).

CONTRACTION, POETIC. See Elision.

CONTRACTOR. See Building Trade; Architecture (Overseeing the Construction).

CONTRAIL is a thin line of cloud that forms behind aircraft at high altitudes. Contrails consist of tiny water droplets or ice crystals. They form when water vapor in the air *condenses* (becomes liquid) or freezes. Contrails are also called *condensation trails*, *exhaust trails*, or *vapor trails*.

A contrail may form in three ways. (1) When a plane moves through the air, the pressure of the air over its wings and around its propellers drops. As the pressure drops, so does the temperature of the air, and the water vapor in it may condense. (2) The exhaust from an aircraft engine contains water vapor. This vapor may condense when it reaches the cold air around the plane. (3) Air rises if heated by an aircraft engine or its exhaust. The pressure and temperature of the air drop as the air rises, causing the water vapor in it to condense.

Contrails may have some effect on the weather. For example, ice crystals from a contrail may cause rain or snow to fall from certain clouds. The crystals act like the chemicals men use when "seeding" clouds to make rain. John H. Glenn

CONTRALTO, *kuhn TRAL toh*, is the lowest voice a woman can sing, and falls in the lower register of an alto voice. Some parts in music are written either for a woman singing contralto or for a man singing the same part. He is called a *countertenor*.

CONTREDANSE. See Dancing (During the 1600's).

CONTRERAS, BATTLE OF. See Mexican War (Scott's Campaign).

CONTROL GROUP. See Experimentation, Scientific.

CONTROL ROD. See Nuclear Reactor (illustration).

CONUNDRUM. See Riddle.

CONURBATION. See Great Britain (Population); Megalopolis.

CONVECTION. See Heat (How Heat Travels).

CONVECTION CURRENTS. See Continental Drift.

CONVENT is a religious community of either men or women who have taken strict vows and live under religious rule. The term is usually applied to an order or society of female Christian nuns, and especially to the building in which they live.

In an *enclosed* convent, the sisters and novices are fully isolated from the outside world. In their cloistered life, they seek their own salvation and that of others through a program of worship, prayer, and contemplation. The Carmelite and Dominican Nuns of the Perpetual Adoration (Second Order) are contemplative orders. *Unenclosed* convents include active orders, societies, and institutes that conduct schools, maintain hospitals, run children's and old people's homes, and take part in other types of social services. Examples are the Little Sisters of the Poor and the Sisters of Charity and Christian Instruction. To some degree, almost all orders seek to combine the two ways of life. The head of a convent is usually called *mother superior*, but may have a different title, such as *abbess*.

Buddhist and Taoist nuns also live in convents. They devote themselves completely to contemplative lives, but are not as fully isolated from society as the Christian contemplative orders. R. Pierce Beaver

See also Cloister; Monasticism; Nun.

CONVENTION is a meeting held by a large organization, usually national in scope, to consider problems, draft policies, and plan future activities. Local chapters send representatives, called *delegates*. Most organizations, such as the American Legion, hold a convention every year. All delegates may meet together for one or more sessions, but the delegates usually transact most convention business during smaller sectional meetings.

Political parties customarily hold conventions to

plan campaigns and select candidates for elections. In the United States, the major political parties hold national conventions every four years to select presidential and vice-presidential candidates. W. HAYES YEAGER

See also POLITICAL CONVENTION.

CONVERSATION is the spoken exchange of ideas and opinions with others. The ability to engage in interesting conversation is one of the greatest assets a person can have. It is an aid to business and social success, and helps one to enjoy more fully the company of others.

Sincerity and naturalness are marks of the good conversationalist. The person who speaks sincerely can often gain listeners even if his words do not flow easily. And the person who talks in a natural, relaxed manner about interesting subjects usually wins an audience.

A pleasant tone of voice adds finish to conversation. Many people speak loudly and harshly. Others speak rapidly and in so low a tone that their words are lost. Words should be spoken clearly and should not be run together. A pleasant tone is especially important in telephone conversation because the voice is the speaker's only method of expressing his feelings.

Striking phrases and unusual words add color to a conversation. Reading is one of the best methods of building a strong vocabulary.

Related Articles in WORLD BOOK include:

Etiquette	Language	Vocabulary
Introductions	Speech	Voice

CONVERSE COLLEGE. See UNIVERSITIES AND COLLEGES (table).

CONVERSION. See PETROLEUM (Refining).

CONVERTER is a device used to convert electrical energy from alternating current to direct current. An *inverted converter* changes direct current to alternating current. See also ELECTRIC CURRENT.

CONVERTIBILITY, *kuhn VUR tuh BIHL uh tee*, is the privilege of exchanging the currency of one nation for that of another. This privilege plays an important role in international trade. For example, an importer from nation A buying goods from nation B must find a way to pay for them. This is much easier if the two currencies are convertible, because all he needs to do is go to his bank and purchase a check for an equivalent amount in B's currency. Otherwise, he can buy goods only to the extent that he has B's currency. One problem in achieving true worldwide convertibility is the difference in economic strength and stability among nations. See also MONEY (Money Around the World; table: Values of Monetary Units); INTERNATIONAL TRADE (Financing International Trade). LEONARD C. R. LANGER

CONVERTIPLANE is an aircraft designed to fly horizontally, and also to land and take off vertically. Such aircraft can usually *hover* (remain motionless) in the air. They are also known as *VTOLs* (vertical take-off and landing) and *STOLs* (short take-off and landing). The term *V/STOL* (vertical or short take-off and landing) includes all types of convertiplanes.

Convertiplanes have great commercial and military possibilities because they need only a small landing space compared to that for conventional aircraft. With convertiplanes, commercial airlines could operate from the tops of buildings or small landing areas in the heart of a city. One of the problems of military aircraft operations is the difficulty of building and maintaining suitable airfields. Military convertiplanes, however, could operate in any area where there was room enough to land or where a small landing field could be built.

Hawker Siddeley Aviation Ltd.

A Convertiplane, such as the Hawker Siddeley *Harrier*, above, can fly from any small, open area. It takes off and lands vertically, like a helicopter. But once in the air, it flies like a plane.

How They Work. A variety of systems have been developed for achieving both horizontal and vertical flight. In general, however, there are two basic types.

One type has two separate propulsion systems—one for vertical flight and the other for horizontal flight. For example, the Sikorsky Stowed Rotor VTOL covers the helicopter rotors it uses for vertical flight when it reaches speeds over 150 mph (241 kph).

The second type of convertiplane often looks more like a conventional aircraft. It uses only one propulsion system for both horizontal and vertical flight. It has jet, propeller, or ducted fan engines mounted in the fuselage or on the wings. They operate by tilting or rotating the wings, engines, or the entire aircraft to fly in the desired direction. Or they may use vanes or flaps to deflect the jet thrust or air blast from the engines downward for vertical flight. The Ryan XV-5A is an example of this second type of aircraft. It has a ducted fan mounted on each wing. See DUCTED PROPELLER.

History. Active experiments on convertiplanes began in 1937 with models tested by Gerard Herrick of New York City and E. Burke Wilford of Philadelphia. In 1955, the U.S. Department of Defense reported testing the first successful convertiplane, the McDonnell XV-1. Since then, many airplane manufacturers have built numerous experimental convertiplanes with steadily better performance. In 1942, convertiplanes were not available at any price. In 1952, they cost twice as much as a conventional plane. Today, they cost 30 to 40 per cent more than ordinary aircraft. LESLIE A. BRYAN

See also AIRPLANE (Aircraft of the Future); AUTOGIRO; HELICOPTER.

CONVEYOR BELT is a device that *conveys* (carries) large quantities of material from place to place. It consists of an endless belt that is looped over two pulleys. One of the pulleys is called the *drive pulley*, and supplies the power that keeps the belt moving. Most conveyor belts are powered by an electric motor.

The belt travels over a series of rollers that reduce friction and support the belt. The material moves along

the belt at a moderate speed in a straight line. A conveyor belt can carry material at a much steeper grade, or slant, than can a truck or a railroad train. The steepness of the grade is limited only by the slant at which the material will slide down the belt.

Conveyor belts such as those used in mines and quarries may be 1 mile (1.6 kilometers) or more in length. The longest conveyor belt in the world—5½ miles (9 kilometers) in length—is located in Oklahoma. The belt carries limestone from a quarry to a cement mill.

Types of Conveyor Belts. The belt of a conveyor may be flat and wide, and the materials simply placed on the belt to be carried away. But for moving bulk material, such as sugar or salt, the belt forms a trough so the material can be moved without spilling. Other conveyor belts consist of chains that have buckets hanging from the chain. Some chain belts have either hooks or scoops that pick up the material and carry it along.

Many times, a conveyor belt makes up only a part of a much larger conveyor system. If the system must change directions or turn a corner, the material is dropped from one belt to another belt that moves in the desired direction. In such a system, each belt is called a *flight*. Different flights are needed for each change of direction required.

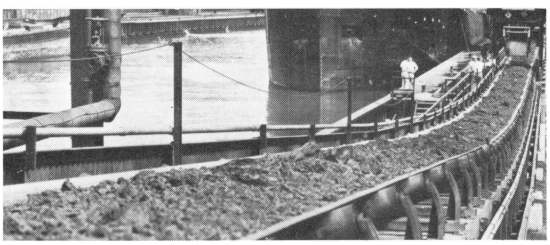
Uses. Conveyor belts play an important part in mass production. Automobiles, for example, move along the assembly line on a conveyor system (see ASSEMBLY LINE). Workers stand in one place, and the materials to be worked on move past them. In airports, conveyor belts carry luggage from the ticket counter to the baggage room. Many buildings now use moving sidewalks, which consist of a ramplike conveyor belt with handrails. An escalator is a conveyor belt designed to form stairs as it moves around as an endless belt. In meatpacking plants, conveyor belts carry the carcasses of the animals from one station to another to be processed.

Conveyor belts are widely used to load and unload ships, trucks, and railroad cars. One such system moves over 6,000 short tons (5,400 metric tons) of coal an hour in a steady stream from railroad cars to the belt. The belt carries the coal to a loading tower that distributes the coal to the various parts of the ship. Mines transport their ores to ships or factories in much the same way.

Many industries use special types of conveyor belts to make their products. Large bakeries, for example, use conveyor belts to speed up the baking of bread. The mixed dough is placed in pans and put on an endless belt that passes through a walled oven over 100 feet (30 meters) long. It takes about 30 minutes to carry the pans through the oven. The continuous movement of a number of these belts allows large bakeries to bake over 30,000 loaves of bread an hour. ROBERT G. HENNES

See also AUTOMOBILE (Assembly; diagram: Assembling an Automobile); CABLE CAR.

CONVEYOR BELT



Link-Belt Company

Trough Conveyor Belts Are Used to Move Bulk Material.

Link-Belt Company

A Moving Sidewalk Is Actually a Flat Conveyor Belt.

H. Armstrong Roberts

A Conveyor Belt Carries Dolls Along an Assembly Line.

CONVOLVULUS, *kuhn VAHL vyuh luhs*, is a *genus* (group) of plants in the morning-glory family. Scientists know of about 200 kinds. Some, such as bindweed, are weeds. Scammony and others are used in medicines. Still other kinds of convolvulus are grown for their beauty.

Related Articles in WORLD BOOK include:

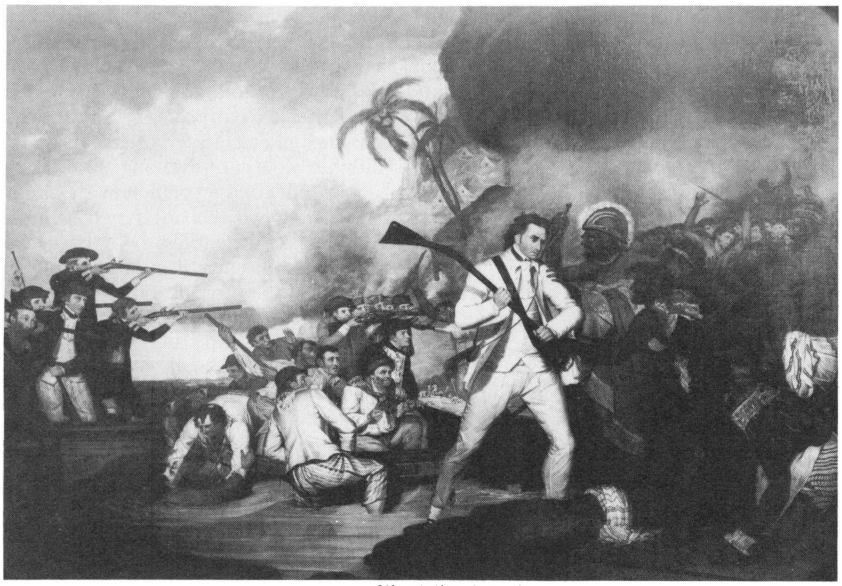
Bindweed	Moonflower	Scammony
Dodder	Morning-Glory	Sweet Potato
Jalap		

CONVOY is a group of merchant ships sailing under the protection of one or more warships. Attacks by German submarines made it necessary for almost all Atlantic shipping to move in convoys during World Wars I and II. During World War II, the United States built the *destroyer escort* for convoy duty, and the British and Canadians developed the *corvette*. These warships were light destroyers, armed with depth charges and light guns. The Allies also built special aircraft carriers, called *escort carriers*, to provide air protection against submarine attack. THEODORE ROPP

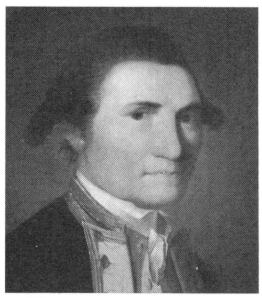
See also AIRCRAFT CARRIER; CORVETTE; DESTROYER.

CONVULSIONS are violent, completely involuntary contractions of the muscles. They may be signs of damage to brain tissue, such as might result from injury, infections, or tumors. They also may occur during many physical or mental illnesses. In young children, convulsions often accompany acute infections and fever. Convulsions of various degrees occur in epilepsy.

Convulsions vary in form or degree. Sometimes the whole body becomes rigid. Or the person may twist and turn his body, and the muscles of his face, legs, and arms may twitch. In some types of epilepsy, only one



Oil painting from the National Library of Australia, Canberra



Detail of an oil portrait by John Webber; National Portrait Gallery, London

James Cook, *above,* **a British navigator, explored many islands in the Pacific Ocean. He landed on the Hawaiian Islands in 1778 and was killed by the Hawaiians during a fight the next year. George Carter painted *The Death of Captain Cook, left.***

limb, or even just a part of it, may be involved in the convulsion. Treatment of convulsions depends on the cause. A doctor should always be called for a patient with convulsions. LOUIS D. BOSHES

See also EPILEPSY.

CONWAY, THOMAS. See CABAL; WASHINGTON, GEORGE (The Army).

CONWAY CABAL. See CABAL.

CONY, *KOH nee,* or CONEY, also called HYRAX, is a rabbit-sized animal resembling a guinea pig. It lives in Africa and southwestern Asia. Conies have short legs, ears, and tails, and they have broad nails on their paws. They are related to the hoofed animals. Some conies live in rocky hills, and others live in trees. The cry of the species that lives in West Africa has been described as "agonized screeching." Conies are mentioned in the English version of the Bible. In addition to hyraxes, certain other rabbit-like animals as well as some rabbits and fishes are called *conies.* The term *coney* is also a trade name for a particular kind of rabbit fur.

N.Y. Zoological Society

The Tree Hyrax lives a solitary life in the forest. The male "talks" with its neighbors by letting out a long, swelling howl.

Scientific Classification. The cony belongs to the order *Hyracoidea.* The cony is a member of the coney family, *Procaviidae.* FRANK B. GOLLEY

See also FUR (Rabbit); PIKA.

CONYNE, SILAS J. See KITE (The Conyne Kite).

COOCH'S BRIDGE. See DELAWARE (The Revolutionary War).

COOK, FREDERICK ALBERT (1865-1940), an American explorer, claimed that he discovered the North Pole in April, 1908. His story was questioned when Robert Edwin Peary returned from a polar expedition in September, 1909. Danish scientists investigated, and announced that Cook did not have sufficient proof of claims. His claim that he reached the summit of Mount McKinley, Alaska, also was disputed. Cook was imprisoned in 1923 for fraudulent use of the mails. He was born in Callicoon Depot, N.Y. JOHN EDWARDS CASWELL

COOK, JAMES (1728-1779), a British navigator, became a famous explorer of the Pacific Ocean. He made three voyages to the South Pacific region and mapped the area with scientific accuracy and remarkable precision. His first valuable service was a survey of the Saint Lawrence River and the Newfoundland Coast. This work won the attention of the British government, and Cook received command of three expeditions to the South Pacific. He left Plymouth, England, in 1768 on his first voyage. He sailed around Cape Horn and reached New Zealand, where he mapped the North and South islands. In 1770, Cook sailed along the east coast of Australia. He claimed a large area for Great Britain and named it New South Wales. Cook returned to England in 1771.

Cook started on a second voyage in 1772 to investigate whether or not a continent extended from the South Pacific to the South Pole. Geographers had speculated on the existence of such a continent for hundreds

of years. Cook made important discoveries on this voyage. He became the first known person to sail across the Antarctic Circle, and discovered the large island of South Georgia. His pioneer work led him to conclude that a frozen continent lay farther south in the Antarctic. Later explorers proved him to be right.

On his third voyage, from 1776 to 1779, Cook proved that there was no direct water route from the Pacific Ocean to Hudson Bay. He left England, sailed eastward through the Cape of Good Hope, and reached New Zealand in 1777. He continued northeastward, stopped at the Sandwich Islands (now Hawaii), and landed on the western coast of North America in 1778 (see HAWAII [History]). Cook sailed up the coast, made charts, explored the vicinity of Bering Strait, and then returned to Hawaii. He was killed by the islanders in 1779.

Cook was born in Marton, Yorkshire. He joined the British navy as a seaman, and rose rapidly to positions of command and responsibility. JAMES G. ALLEN

See also BRITISH COLUMBIA (Discovery); EXPLORATION AND DISCOVERY (map); AUSTRALIA (History [map]).

COOK, MOUNT. See MOUNT COOK.

COOK COUNTY. See CHICAGO (Metropolitan Area).

COOK ISLANDS lie in the South Pacific Ocean, about 1,800 miles (2,900 kilometers) northeast of New Zealand. For location, see PACIFIC ISLANDS (color map). The islands are a dependency of New Zealand. They cover 93 square miles (241 square kilometers) and have a 90-mile (145-kilometer) coastline. The main islands include Rarotonga, Mangaia, Atiu, Aitutaki, Mauke, and three small islets. The capital is Avarua, on the northern shore of Rarotonga. Manihiki and several other islands to the north are administered by the Cook Islands. The islands have fertile soil and a mild climate. Their chief exports include copra, fruits, and tomatoes. Most of the 22,000 people are Polynesians.

In 1773, Captain James Cook became the first known European to reach the islands. Britain took control of them in 1888, and gave administrative control to New Zealand in 1901. A new constitution gave the islanders control of their internal affairs in 1965. EDWIN H. BRYAN, JR.

COOKE, JAY (1821-1905), an American financier, was the chief financial agent for the United States during the Civil War. He sold war loans, which totaled well over $1 billion. Cooke was born in Sandusky, Ohio. He worked his way up from a clerkship in a Philadelphia bank to the establishment of his own banking firm in 1861. In 1873, the failure of his company helped bring on a general financial panic. In 1878 and 1879, Cooke made another fortune in Western silver mines. KENNETH WIGGINS PORTER

COOKE, TERENCE JAMES CARDINAL (1921-), archbishop of New York, was appointed a cardinal of the Roman Catholic Church in 1969 by Pope Paul VI. Cooke, at 48, was the youngest American ever to become a cardinal. Cardinal Cooke was born and raised in New York City. He was ordained in 1945 after graduating from St. Joseph's Seminary in Yonkers, N.Y. He earned a master's degree in social work at the Catholic University of America in Washington, D.C., and taught at Fordham University in New York City. He became archbishop of New York in 1968. THOMAS P. NEILL

COOKE, WILLIAM F. See TELEGRAPH (Development).

COOKING is the art and science of preparing foods for the table, usually by heating them until they are changed in flavor, tenderness, appearance, and chemical composition. Cooking helps develop the flavor of food, and makes many foods more attractive in appearance.

Cooking also makes some foods easier to digest. Because the effect of food is so important to health, cooking has developed into a science, and is so taught in schools and colleges.

History of Cooking

It is not known when, how, or by what people the art of cooking was first discovered. Prehistoric hunters probably cooked some of their food. Even before these prehistoric people knew how to make fire, they cooked over burning wood taken from fires that had started naturally. Men learned to make fire about 500,000 years ago.

In some very hot climates, such as the deserts in the southwestern part of the United States, some food was cooked by baking or drying on flat stones placed in the hot sun. The Indians baked their thin corn cakes in this manner.

The first broiling was done by placing the food on a stick and holding it over hot coals. Later this stick was made of an iron rod called a *spit*, which was put over the fire. The food was pushed on the stick, and turned frequently to cook it on all sides and to keep it from burning.

Cooking on a flat stove with a fire built around it was also known very early. As people continued to learn about cooking, they dug pits in the ground, lined them with stones, and built fires on them. After the stones were heated the food was placed on them, covered with green leaves, and left to cook.

Boiling, which is cooking in water, could not be done

Rae Russell

Cooking at Home, young girls and boys can practice preparing meals by trying to follow the details of a recipe accurately.

until the invention of containers which held water and which were not destroyed by heat. Among the earliest pots were those made by prehistoric people about 6000 B.C. Later the Eskimos used similar pots. Skin bags and birch-bark kettles were used early by the American Indians. Cooking was done by dropping hot stones into the containers of food. As the stones cooled off, more hot ones were added.

The ancient Egyptians knew at least six forms of cooking, including baking, broiling, roasting, boiling, frying, and stewing. The ancient Jews also knew a great deal about cooking. The book of Genesis in the Bible tells the story of Rebecca who prepared kid so that it tasted like venison and gave it to Isaac (Genesis 27). Assyrian and Babylonian carvings of about 750 B.C. show cooking being done over a pan of charcoal, called a *brazier*.

The Romans, who were famous for their banquets, prepared food by cooking it over charcoal on grills, or on stone hearths. Permanent types of ovens have been found among the ruins of Pompeii. The manuscripts of the Middle Ages tell us that boiling and broiling were the two most common methods of cooking at that time. A type of bread was often made in an oven which resembled a beehive. Such ovens were found only in the "great houses" of the wealthy or in public bakeries of Europe until long after America was discovered. In colonial North America, however, nearly every home had an oven of its own, because homes were usually far apart and the forests were full of dangers.

Closed stoves of brick or porcelain tile have been in use in northern European countries since the end of the Middle Ages. Cast-iron stoves were used in Alsace as early as 1490. But it was not until the 1800's that cookstoves became popular. Before that time, the people in America and other countries cooked in kettles over the fireplace or on an open fire outdoors. Ovens for baking were built into the fireplace. Dutch ovens, large cylinders with shelves and open on one side, were set beside the fire. Roasting was done on spits.

Modern Improvements in Cooking

The methods of cooking changed as equipment for cooking became better in design and materials. Women learned to save the juices which dripped from the meat as it was being roasted, and to make sauces to serve with it. They learned to use seasonings of various kinds, and how to combine foods to give new and tastier dishes that were more pleasing in appearance. The appearance of food has a powerful effect on the appetite.

Modern methods of cooking are based on the methods of earlier times. But they are carried on with the aid of modern cooking utensils of metals, glass, or enamel, and with modern equipment. Such equipment includes mechanically operated stoves, beaters, refrigerators, and many electrical appliances. Gas, kerosene, coal, electricity, and wood are the main sources of energy or heat used in cooking.

Recipes. Until very recently, recipes told one to take a "handful" of this ingredient, "fat the size of a walnut," a "pinch" or a "smidgen" of seasoning, and perhaps "enough liquid to make a dough." Sometimes the recipe said to "use your own judgment." Naturally, an inexperienced person had a difficult time learning to cook. With tested recipes and equipment of standard sizes, there can be little doubt in the cook's mind about the amounts of ingredients to use, or the methods of preparation. The texture and flavor of foods are controlled to a large degree by the skill and cleverness with which the ingredients are combined. The skill of the greatest chefs can now be duplicated in the home kitchen.

Making More Foods Available. Another important change in cooking has come about by the development of transportation. Foods once unknown in one part of the world are to be found regularly in food stores now. They can be shipped in refrigerated trucks or trains and by air. Cold storage, fast freezing, canning, and modern methods of dehydration have also provided a wider variety of foods which can be used in the home all the year round. Canned foods and commercially packaged foods are often partly cooked. For this reason, food preparation does not take as much time as it did before.

There are many special directions for preparing foods, both fresh and stored. Foods kept in cold storage may be used exactly as fresh foods are. Those which are fast-frozen must be thawed before they can be used in some recipes. But vegetables which are to be heated, seasoned, and served in the same form in which they are packed may be put on the stove while they are frozen. More food value is retained by this method. They usually contain enough moisture so that none need be added during cooking. The liquid in which foods are canned should be used in soup, or boiled down to the needed amount and served with the foods, since it contains minerals and vitamins needed by the body.

Dehydrated foods have been dried by the sun or by heat to preserve them, shrink them in size, and make them lighter in weight. Most dried foods are soaked before they are cooked. Water is added to them to replace that which was evaporated.

Methods of Cooking

Cooking is done by several means, all of which use either dry or moist heat. Methods using dry heat are roasting, baking, broiling, pan-broiling, and frying. The first four mentioned use air in connection with the heat. Frying uses fat. Moist heat employs water or steam. Boiling, simmering, stewing, steaming, waterless cooking, and pressure cooking apply moist heat.

It is usually desirable to retain as much of the natural flavor and color as possible in cooking vegetables and fruits. This often means cooking them in as little water as possible only until they are tender. This method preserves the food value. Alkalies such as soda should not be added to vegetables. They increase the speed of cooking, but that is all.

Roasting is done by placing the food in the oven or over coals, and cooking until it is tender. Tough cuts of meat should not be prepared in this way. Dry heat tends to harden the connecting tissues. It gives tender cuts a very delicious flavor, since they retain most of their juices. Meats should be roasted at a low temperature, usually from 300° to 350° F. (150° to 180° C). Such temperatures do not evaporate the juices. The meat does not taste dry, and there is little shrinkage. A thermometer may be inserted in the middle of the

largest muscle of the roast, not too near a bone. It will tell when the meat is cooked to the proper degree at the center.

Baking is similar to roasting. It is used for preparing many types of cakes, breads, vegetables, fruits, main dishes, and meats. The food is placed in the oven at the temperature recommended in the recipe used and cooked until done. Excess moisture in the food is evaporated during the cooking process. Other changes also take place. Oven temperatures are sometimes indicated as slow, medium, or hot. A *slow* oven temperature ranges from 250 to 325° F. (121° to 163° C), and is used for baked dishes containing a large amount of egg or cheese. A *medium* oven ranges from 325 to 400° F. (163° to 200° C), and is used for cakes, some breads, and most vegetables. A *hot* oven, over 400° F. (200° C), is used for most breads, rolls, quick breads, pie shells, and other similar foods.

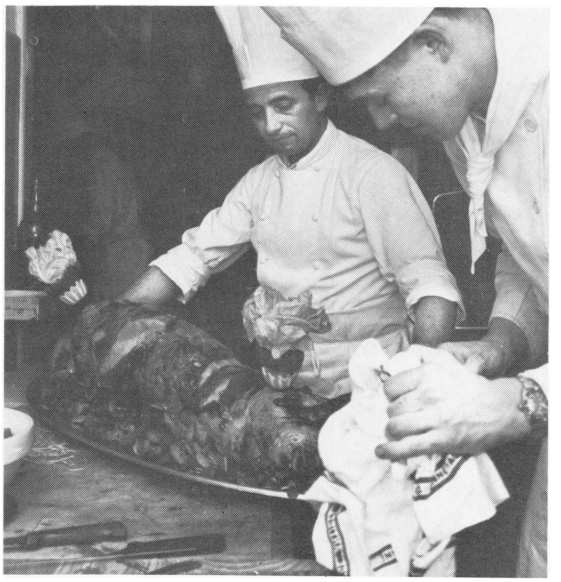
Broiling is done by placing the food on racks immediately under a flame or electric unit, or directly over hot coals. The food is cooked on one side until it is done halfway through. Then it is turned over, and continued until the food is cooked to the desired degree. This method is used for very tender cuts of meat and for certain fruits and vegetables. It is the method most frequently used at picnics for "weenie roasts." A hot skillet is used to *pan-broil*. The food is placed in it, and grease or moisture is poured off as it collects.

Frying is cooking food in fat. At first the term applied to deep-fat frying, and the word *sauté* was used for the preparation of food in a small amount of fat. But frying has gradually come to mean cooking foods in any amount of fat. French-fried potatoes, doughnuts, and many other foods are prepared by the deep-fat method, which uses a kettle full of oil or fat. Most tender foods may be prepared in a small amount of fat.

Boiling and Simmering are methods of cooking foods in enough water to cover them. They differ only in the temperature used. Water at sea level boils at 212° F. (100° C). Foods cooked at a lower temperature are said to be *simmered*. *Stewing* is cooking food at simmering temperatures in a small amount of water. This method is particularly good for tough cuts of meat. The water and low cooking temperatures soften the connective tissue and make the meat tender.

Braising is the term used in meat cookery by which the meat is first browned, then has a small amount of water added.

Steaming is a method of cooking in which a small amount of water is reduced to steam. The steam surrounds the food and cooks it. Steam cooking may be done by various methods. The food may be placed in a small amount of water in a covered pan and heated. Vegetables may be placed in a parchment bag, sealed, and dropped into a pot of boiling water. The moisture on the vegetables turns to steam and cooks the food. Double boilers are sets of two pans which fit together so that water may be converted into steam in the lower pan to cook the food in the upper pan. Other steamers are built like portable ovens, with pans of water beneath the shelves. Steam under pressure, as produced in the pressure cooker, is used to cook foods very quickly. The pressure is registered on a gauge on top of the cooker. There is a temperature rise in the cooker with increasing pressure. Pressure cookers may be purchased in sizes ranging from about 2 to 20 quarts (1.9 to 19 liters). The larger sizes usually have racks with sets of pans. Several kinds of foods requiring similar cooking times can thus be prepared at once.



S. Weiss, Rapho Guillumette

Restaurant Chefs put the finishing touches on a young roasted pig. Roasting makes meat moist and tender.

Seasoning. To the epicure, the difference between excellent food and good food is often in the seasoning. Salt and pepper are used by most persons, but other seasonings may be used. A group of small plants, called *herbs*, are dried or used fresh to give delightfully different flavors. In this group of plants are mint, basil, thyme, parsley, sage, dill, tarragon, mustard, cress, savory, and horse-radish. Leeks, garlic, onions, and shallots are also used for seasoning. Flowers have been frequently added for flavoring. Petals of violets, roses, marigolds, and nasturtiums are used, as well as poppy, caraway, anise, and other seeds. The leaf of the bay tree is another seasoning. Herbs make foods more appetizing. Often a blend of several herbs is more satisfying than one alone. Prepared seasonings, such as mustard, catchup, and horseradish, are also used on foods, either while they are being prepared or just before they are eaten.

HELEN MARLEY CALAWAY

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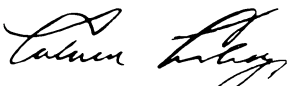
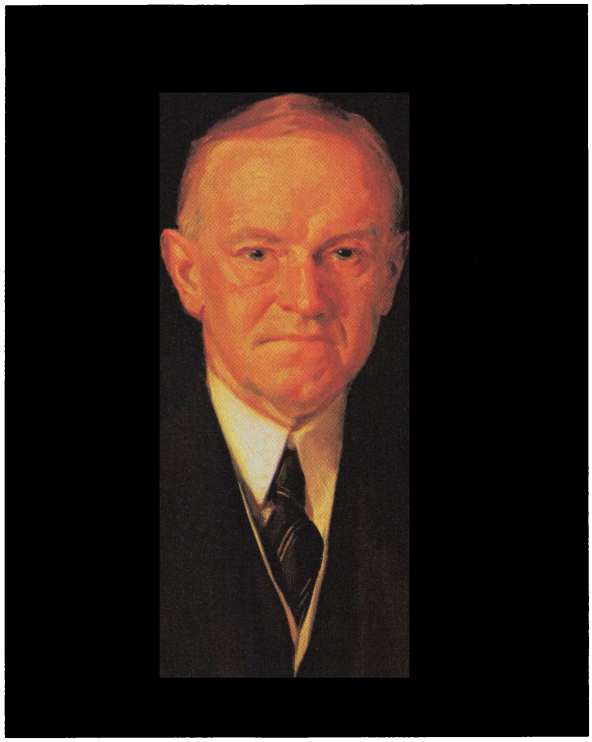


CALVIN COOLIDGE



Oil painting on canvas by Wayman Adams; Union League Club, New York City

The United States Flag had 48 stars when Coolidge took office.

WILSON
28th President
1913 — 1921

HARDING
29th President
1921 — 1923

HOOVER
31st President
1929 — 1933

F. D. ROOSEVELT
32nd President
1933 — 1945

30TH PRESIDENT OF THE UNITED STATES 1923-1929

COOLIDGE, CALVIN (1872-1933), was a shy, silent New England Republican who led the United States during the boisterous Jazz Age of the 1920's. He was the sixth Vice-President to become President upon the death of a chief executive. Coolidge was vacationing on his father's farm in Vermont when President Warren G. Harding died in 1923. The elder Coolidge, a notary public, administered the oath of office in the dining room. Never before had this ceremony been performed by such a minor official or by a President's father.

In 1924, Coolidge was elected to a full four-year term. He enjoyed great popularity and probably could have been re-elected. But he decided to retire. His terse announcement became his most famous statement: "I do not choose to run for President in 1928." Herbert Hoover succeeded him.

Americans respected the views of the closemouthed Coolidge, although he seldom said anything very original or profound. His reputation for wisdom was based on his dry wit and robust common sense. He issued few unnecessary public statements and rarely wasted a word.

Coolidge, who had risen to fame as governor of Massachusetts, served as President during the Roaring 20's. Prosperity stimulated carefree behavior and a craving for entertainment. The nation's "flaming youth," featured in the novels of F. Scott Fitzgerald, set the pace. Sports figures became national heroes as Babe Ruth hit 60 home runs in one season and Gene Tunney defeated Jack Dempsey in the famous "long-count" bout. Charles A. Lindbergh made the first solo flight across the Atlantic Ocean. Motion pictures began to talk, with Al Jolson starring in *The Jazz Singer*. George Gershwin brought jazz into the concert hall with his *Rhapsody in Blue*. Americans defied Prohibition, and Al Capone and other gangsters grew rich by bootlegging liquor. A popular song summed up the whole era: "Ain't We Got Fun?"

The solemn, frugal Coolidge seemed to be a misfit from another era. But people voted for him even if they did not imitate his conduct. They cherished him for having the virtues of their pioneer forefathers.

Early Life

Childhood. Calvin Coolidge was born on Independence Day, July 4, 1872, in Plymouth Notch, a village near Woodstock in central Vermont. He was named for his father, John Calvin Coolidge, but his parents called him *Calvin*, or *Cal*. He dropped the name *John* after leaving college.

Calvin's parents had been childhood playmates in Plymouth Notch. His father was descended from an English family that came to America about 1630. When Calvin was 4 and his sister, Abigail, was 1, his father bought a small farm across the road from the family store. Cal helped with the farm chores and studied in a small stone schoolhouse nearby.

The elder Coolidge served three terms in the Vermont

house of representatives and one term in the state senate, and held many local public offices. He passed his political shrewdness on to his son.

Education. Coolidge's mother, Victoria Josephine Moor Coolidge, died when he was 12 years old. The next year he entered Black River Academy at nearby Ludlow. He was graduated in 1890. His sister, who also attended the school, had died of an intestinal ailment a short time before. He took a short course at St. Johnsbury Academy, and entered Amherst College in 1891.

Coolidge made his first appearance as an orator in 1892, when he delivered the Independence Day address in his home town. As a college student, he showed great interest in political campaigns. He earned only fair grades during his first two years, but was graduated *cum laude* in 1895.

Coolidge then read law with the firm of Hammond and Field in Northampton, Mass. He passed the Massachusetts bar examination in 1897, and about seven months later opened his own office in Northampton.

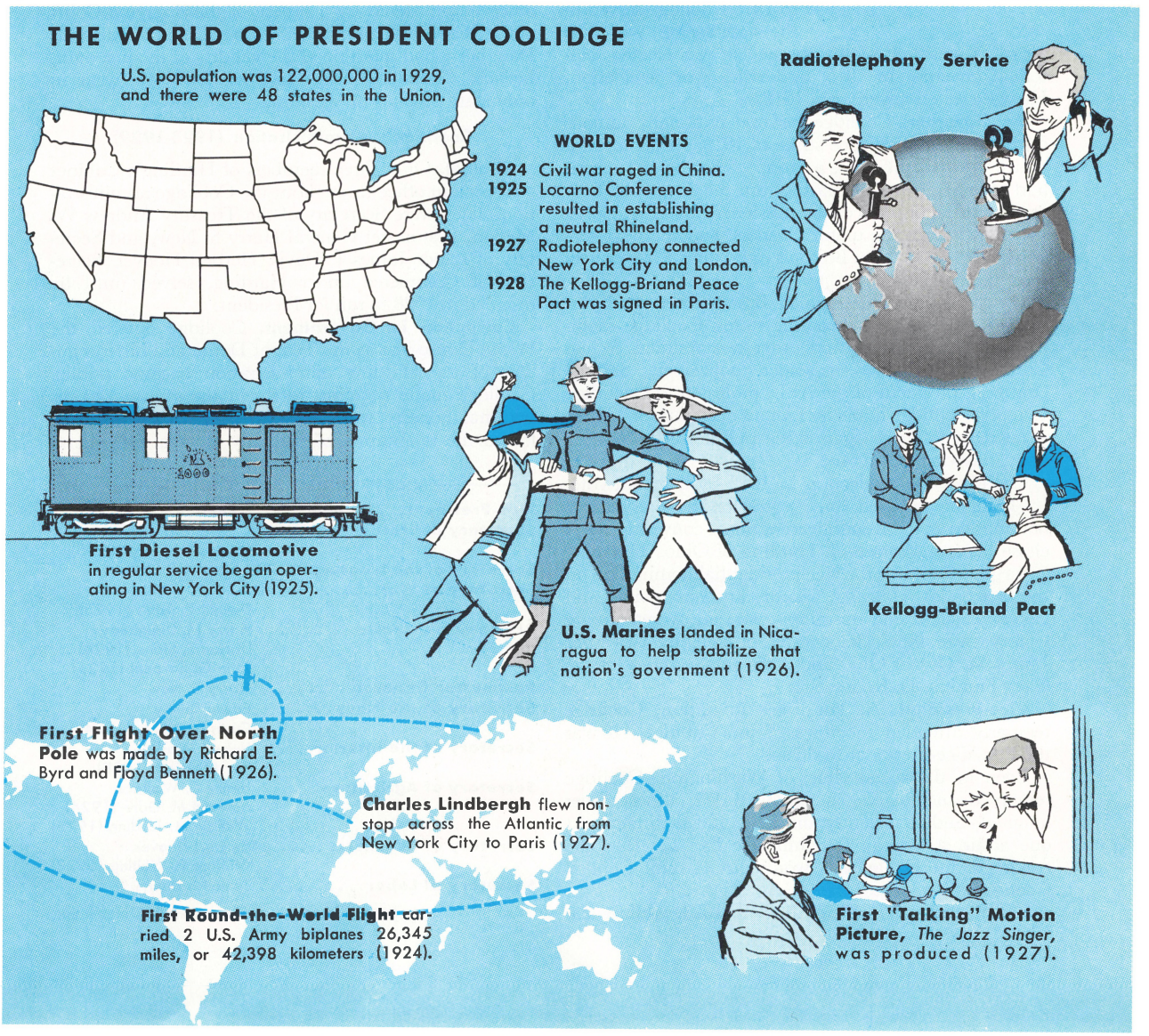
IMPORTANT DATES IN COOLIDGE'S LIFE

1872 (July 4) Born in Plymouth Notch, Vt.
1905 (Oct. 4) Married Grace Anna Goodhue.
1906 Elected to Massachusetts house of representatives.
1909 Elected mayor of Northampton, Mass.
1911 Elected to Massachusetts senate.
1915 Elected lieutenant governor of Massachusetts.
1918 Elected governor of Massachusetts.
1920 Elected Vice-President.
1923 (Aug. 3) Became President of the United States.
1924 Elected to full term as President.
1933 (Jan. 5) Died in Northampton, Mass.

Political and Public Activities

Entry into Politics. Coolidge became an active worker for the Republican party in 1896. He was elected to the Northampton city council in 1898, and became city solicitor in 1900. He won re-election in 1901, but lost in 1902.

In 1904, Coolidge met his future wife, Grace Anna Goodhue (Jan. 3, 1879-July 8, 1957), a teacher at the Clarke School for the Deaf in Northampton. She was gay, talkative, and fun-loving—just the opposite of the quiet Coolidge. Shortly after their marriage on Oct. 4,



Harris & Ewing

Grace Coolidge had a fun-loving personality in contrast to her husband, "Silent Cal."

1905, he arrived home from his office with a bag containing 52 pairs of socks, all with holes. When his bride asked if he had married her to darn his socks, Coolidge, with characteristic bluntness, replied: "No, but I find it mighty handy." The couple had two sons, John (1906-), who became a business executive, and Calvin, Jr. (1908-1924).

Coolidge was elected to the Massachusetts house of representatives in 1906, and was re-elected the next year. He won election as mayor of Northampton in 1909, and was returned to office in 1910. From 1912 to 1915 Coolidge served in the state senate, with two terms as president of that body. He was elected lieutenant governor in 1915, and twice won re-election. He was elected governor in 1918.

As Governor, Coolidge became nationally famous during the Boston police strike of 1919. In defiance of police department rules, a group of Boston policemen had obtained a union charter from the American Federation of Labor. Police Commissioner Edwin U. Curtis suspended 19 of the union's leaders, and the next day almost three-fourths of Boston's more than 1,500 policemen went on strike.

Bands of hoodlums roamed Boston for two nights, smashing windows and looting stores. Coolidge mobilized the state guard, and order was restored. When Curtis fired the 19 suspended policemen, Samuel Gompers, president of the AFL, protested to Coolidge. In reply, Coolidge made his famous declaration: "There is no right to strike against the public safety by anybody, anywhere, any time."

Coolidge won re-election in 1919 by a record vote. In 1920, he received some votes for the presidential nomination at the Republican national convention that chose Senator Warren G. Harding of Ohio. The delegates gave Coolidge the vice-presidential nomination on the first ballot. Harding, friendly and easy-going, and Coolidge, silent and unsmiling, won an overwhelming victory over their Democratic opponents, Governor James M. Cox of Ohio and Assistant Secretary of the Navy Franklin D. Roosevelt.

Vice-President. At Harding's invitation, Coolidge regularly attended meetings of the Cabinet. He was the first Vice-President to do so.

Even in the social whirl of Washington, Coolidge remained unchanged. He rarely smiled, almost never laughed, and sat silently through official dinners. At one affair, a woman told him she had bet that she could get more than two words out of him. Replied Coolidge: "You lose."

Early on the morning of Aug. 3, 1923, while vacationing on his father's farm, Coolidge was awakened with the startling news of Harding's death. He dressed and knelt in prayer, then walked downstairs to the dining room. There, by the light of a kerosene lamp, his father administered the presidential oath at 2:45 A.M. After that, President Coolidge went back to bed—and slept. Years afterward, when asked to recall his first thought upon becoming President, he replied: "I thought I could swing it."

Don Sieburg

Coolidge's Birthplace in Plymouth Notch, Vt., is now the rear of this store. The house was once separate from the store.

Eighteen days later, Coolidge had a second oath of office administered by a justice of the Supreme Court of the District of Columbia. Attorney General Harry M. Daugherty had questioned the validity of the first oath, because Coolidge's father had authority to swear in only state officials of Vermont.

Coolidge's Administration (1923-1929)

Cabinet. Only three members of Harding's Cabinet remained in office throughout the Coolidge administration. They were Secretary of the Treasury Andrew W. Mellon, Postmaster General Harry S. New, and Secretary of Labor James J. Davis. Herbert Hoover, Secretary of Commerce under Harding, served until he resigned in 1928 to run for President.

Corruption in Government. Coolidge entered the White House just as the Teapot Dome and other scandals of the Harding administration became public. Coolidge made no effort to shield the guilty, and his personal honesty was never questioned. In 1924, he forced the resignation of Attorney General Daugherty

VICE-PRESIDENT AND CABINET

Vice-President	*Charles G. Dawes
Secretary of State	*Charles Evans Hughes
	*Frank B. Kellogg (1925)
Secretary of the Treasury	*Andrew W. Mellon
Secretary of War	John W. Weeks
	Dwight F. Davis (1925)
Attorney General	Harry M. Daugherty
	*Harlan F. Stone (1924)
	John G. Sargent (1925)
Postmaster General	Harry S. New
Secretary of the Navy	Edwin Denby
	Curtis D. Wilbur (1924)
Secretary of the Interior	Hubert Work
	Roy O. West (1928)
Secretary of Agriculture	Henry C. Wallace
	Howard M. Gore (1924)
	William M. Jardine (1925)
Secretary of Commerce	*Herbert Hoover
	William F. Whiting (1928)
Secretary of Labor	James J. Davis

*Has a separate biography in WORLD BOOK.

and other high officials who had been connected with the scandals. See HARDING, WARREN GAMALIEL (Government Scandals); TEAPOT DOME.

"Constructive Economy." Coolidge continued Harding's policy of supporting American business at home and abroad. He favored a program of what he called "constructive economy," and declared that "The business of America is business." The government continued high tariffs on imports in an effort to help American manufacturers. Although Congress reduced income taxes, revenue from taxes increased and the administration reduced the national debt by about a billion dollars a year. Congress also restricted immigration beyond what it had done in 1921. Coolidge vetoed the World War I veterans' bonus bill, but Congress passed it over his veto.

A paradox of the Coolidge era was that the President stood for economy and a simple way of life, and yet enjoyed great popularity with a public that largely had thrown thrift to the winds. Some economists warned that this period of prosperity would end in a dreadful depression. But most Americans believed that good times had come to stay. Coolidge did not try to stop the speculation which contributed to the stock-market crash of 1929 seven months after he left office.

Farmers did not share in the general prosperity. Farm prices had fallen, and the purchase of farm products by other nations had declined because of a world-wide surplus of agricultural products. Coolidge twice vetoed a bill to permit the government to buy surplus crops and sell them abroad. Coolidge also pocket-vetoed a bill that would have let the government operate the Muscle Shoals power facilities as an electric power project (see MUSCLE SHOALS; VETO).

"Keep Cool with Coolidge." Coolidge had no important rivals for the Republican presidential nomination in 1924. After naming him on the first ballot, the party's national convention chose Charles G. Dawes, Director of the Bureau of the Budget, for Vice-President. The Democrats nominated John W. Davis, former ambassador to Great Britain, for President, and Governor Charles W. Bryan of Nebraska for Vice-President. Dissatisfied members of both parties formed the Progressive party. They nominated Senator Robert M. LaFollette of Wisconsin for President and Senator Burton K. Wheeler of Montana for Vice-President.

Both Democrats and Progressives urged defeat of the Republicans because of the Harding scandals. Republicans replied with the slogan "Keep Cool with Coolidge." Coolidge and Dawes received more than half of the popular votes cast in the election. On March 4, 1925, Chief Justice William Howard Taft became the first former President to administer the presidential oath of office. Coolidge's inaugural address was the first to be broadcast by radio.

COOLIDGE'S ELECTION

Place of Nominating Convention	Cleveland
Ballot on Which Nominated	1st
Democratic Opponent	John W. Davis
Electoral Vote	382 (Coolidge) to 136 (Davis)
Popular Vote	15,718,211 (Coolidge) to 8,385,283 (Davis)
Age at Second Inauguration	52

Foreign Affairs were marked by two main achievements: the improvement of relations with Mexico and the negotiation of the multilateral Kellogg Pact to outlaw war (see KELLOGG PEACE PACT). Coolidge appointed Dwight W. Morrow as ambassador to Mexico. Morrow settled some old disputes and also obtained valuable concessions from Mexico for American and British owners of oil property.

Although Coolidge opposed joining the League of Nations, he favored membership in the World Court. But the Senate placed what he called "unworthy" conditions on membership, and the President let the matter drop. Earlier, in 1923 and 1924, Dawes had directed an international committee that worked out a plan by which Germany could pay its World War I *reparations* (compensation for damages). See DAWES PLAN.

Life in the White House offered an interesting contrast between the taciturn Coolidge and his gay, charming wife. The difference was particularly noticeable at official receptions.

The President had an interest in many behind-the-scenes details of running the White House. He enjoyed appearing unexpectedly in the kitchen to inspect the iceboxes and to comment on future menus. He once protested mildly because he thought 6 hams were too many for 60 dinner guests. Coolidge also liked to play practical jokes on the staff. He would ring for the elevator, then stride quickly down the stairs, or push all the buttons on his desk just to see all his aides run in at once.

Tragedy struck the Coolidges shortly after his nomination in 1924. Their son Calvin developed a blister on a toe while playing tennis with his brother on the White House courts. The resulting infection spread, and the 16-year-old youth died of blood poisoning. "When he went," Coolidge wrote in his autobiography, "the power and the glory of the presidency went with him." In 1926, the President's father died.

"I Do Not Choose to Run . . ." The Coolidges traveled to the Black Hills of South Dakota for a summer vacation in 1927. On August 2, the day before the fourth anniversary of his presidency, Coolidge called newsmen to his office in the Rapid City high school. He handed each reporter a slip of paper on which appeared the words: "I do not choose to run for President in 1928."

Coolidge's announcement caught the nation by surprise, because he had given no clue as to his plans. Coolidge wrote in his autobiography that "The chances of having wise and faithful public service are increased by a change in the presidential office after a moderate length of time." He also mentioned the "heavy strain" of the presidency, and expressed doubt that Mrs. Coolidge could serve four more years as First Lady "without some danger of impairment of her strength."

Coolidge had a typical response when reporters asked him to comment upon leaving the capital: "Good-by, I have had a very enjoyable time in Washington."

Later Years

The Coolidges returned to Northampton, but the stream of tourists past their home made it impossible to enjoy a quiet life. In 1930, Coolidge bought an estate

in Northampton called The Beeches, which had iron gates to keep curious visitors at a distance.

Coolidge published his autobiography in 1929, first in magazine installments, then in book form. The next year, he began writing a series of daily newspaper articles called "Thinking Things Over with Calvin Coolidge." He wrote chiefly about government, economics, and politics. He had become a life trustee of Amherst College in 1921, and was named a director of the New York Life Insurance Company in 1929.

The stock-market crash in October, 1929, and the resulting nationwide depression distressed Coolidge, who felt that he might have done more to prevent it. But, following the renomination of Herbert Hoover in 1932, he said that the depression would have occurred regardless of which party had been in power.

Coolidge became increasingly unhappy as the depression deepened during the fall and winter of 1932. On Jan. 5, 1933, Mrs. Coolidge found him lying on the floor of his bedroom, where he had died of a heart attack. He was buried beside his son and father in the Plymouth Notch cemetery.

Mrs. Coolidge sold The Beeches and built another home in Northampton, where she lived until her death on July 8, 1957. Coolidge had written: "For almost a quarter of a century she has borne with my infirmities, and I have rejoiced in her graces."

Authoritative works on the life of Calvin Coolidge include *Calvin Coolidge, The Man From Vermont* by Claude M. Fuess, and *A Puritan in Babylon* by William Allen White.

GEORGE H. MAYER

Related Articles in WORLD BOOK include:

Dawes, Charles G.
Harding, Warren G.
Hoover, Herbert
Mellon, Andrew W.
Morrow, Dwight W.
President of the United States
Vice-President of the United States

Outline

I. Early Life
- A. Childhood
- B. Education

II. Political and Public Activities
- A. Entry into Politics
- B. As Governor
- C. Vice-President

III. Coolidge's Administration (1923-1929)
- A. Cabinet
- B. Corruption in Government
- C. "Constructive Economy"
- D. "Keep Cool with Coolidge"
- E. Foreign Affairs
- F. Life in the White House
- G. "I Do Not Choose to Run . . ."

IV. Later Years

Questions

What were some unusual features about Coolidge's inaugurations as President?

What made Governor Coolidge nationally famous?

Why did Coolidge abandon the idea of trying to get the United States into the World Court?

When was the slogan "Keep Cool with Coolidge" used?

Why was Coolidge so popular with the people?

How did the investigations of corruption in government affect Coolidge?

In what ways did Coolidge's outlook on life differ from that of the American people as a whole?

What was Coolidge's most famous statement?

How did Coolidge squelch a woman who had bet that she could get him to chat with her?

What tragedy struck Coolidge during his presidency?

COOLIDGE TUBE, another name for X-ray tube. See X RAYS.

COOLING SYSTEM. See AIR CONDITIONING; AUTOMOBILE (The Cooling System).

COON. See RACCOON.

COONEY, BARBARA (1917-), an American illustrator, won the Caldecott medal in 1959 for her illustrations in *Chanticleer and the Fox*. Other books she illustrated include *Rocky Summer* (1948), *Kildee House* (1949), *Yours with Love* (1952), and *Snow Birthday* (1955). She also wrote and illustrated *King of Wreck Island* (1941). She was born in Brooklyn, N.Y.

COONHOUND is a dog bred especially for raccoon hunting. It stands from 23 to 27 inches (58 to 69 centimeters) high. Its highly developed sense of smell makes it an ideal dog for trailing raccoons. Only the *black and tan coonhound* is recognized as a pure breed by the American Kennel Club. It is black with tan on the head, chest, and legs. The five other coonhounds differ chiefly in color. See DOG (picture: Hounds).

OLGA DAKAN

COOPER. See BARREL.

COOPER, GARY (1901-1961), was an American motion-picture actor who appeared in more than 90 films. His cowboy roles in such movies as *The Virginian* (1929) and *The Westerner* (1940) made him a symbol of the courageous pioneer of the American West. In these and other films, including *Meet John Doe* (1941) and *Friendly Persuasion* (1956), Cooper came to represent the common man fighting evil. He won Academy Awards for performances in *Sergeant York* (1941) and *High Noon* (1952).

United Press Int.

Gary Cooper

Cooper's real name was Frank James Cooper. He was born in Helena, Mont. He first gained fame as a romantic leading man in such films as *A Farewell to Arms* (1932). He first won praise from critics for his performance in the comedy *Mr. Deeds Goes to Town* (1936).

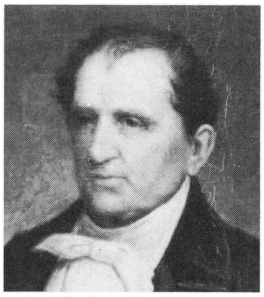
HARVEY R. DENEROFF

COOPER, JAMES FENIMORE (1789-1851), was an American novelist and social critic. He is best known for *The Leatherstocking Tales*, five novels about Natty Bumppo, a frontiersman. The character is also called several other names in the series, including Leatherstocking. In these books, Cooper became the first author to seriously portray American scenes and characters.

In *The Leatherstocking Tales*, Cooper described Natty Bumppo's retreat from the advancing settlement of the frontier. The novels introduce Natty Bumppo as a young man and follow him to old age and death. *The Leatherstocking Tales*, in the order of the hero's life, are *The Deerslayer* (1841), *The Last of the Mohicans* (1826), *The Pathfinder* (1840), *The Pioneers* (1823), and *The Prairie* (1827). These action-filled stories contrast two ways of life. Natty Bumppo and his brave, noble Indian friends live a life of freedom close to nature. The settlers bring civilization and social order to the frontier, but they also selfishly or thoughtlessly misuse the wilderness. See LAST OF THE MOHICANS.

Cooper's conservative ideas about society are re-

flected in his many novels and other writings. His works show his concern for individual freedom and the rights of property owners. Cooper declared that he believed in democracy. But he said he feared that majority rule would bring disorder and injustice to American life. Cooper thought the United States should be governed by a small aristocracy of cultured and public-spirited landowners.



Detail of an oil portrait by Asa Weston Twitchell; The New-York Historical Society, New York City

James Fenimore Cooper

Cooper wrote several nonfiction works criticizing American life. The best known include the essays *A Letter to His Countrymen* (1834) and *The American Democrat* (1838). Cooper's defense of property rights dominates a series of novels called *The Littlepage Manuscripts*. The novels are *Satanstoe* (1845), *The Chainbearer* (1845), and *The Redskins* (1846).

Cooper wrote the first American novel about the sea, *The Pilot* (1823). This novel has a memorable character, Long Tom Coffin, who, like Natty Bumppo, is a humble man who lives close to nature. Cooper also wrote many tales of exciting sea chases.

Cooper was born in Burlington, N.J. He was raised in the frontier community of Cooperstown, N.Y., which was named for his father, William Cooper. *The Pioneers* and *The Deerslayer* are set in the beautiful countryside around Cooperstown. Cooper served in the U.S. Navy from 1806 to 1811. He settled in upstate New York, intending to become a gentleman farmer.

One day, while reading a novel aloud to his wife, Cooper told her he could write a better one. She challenged him to try, so Cooper wrote *Precaution* (1820). This novel received little critical praise. His next novel was *The Spy* (1821), a story about the Revolutionary War. Its immediate success encouraged Cooper to devote himself to writing. DEAN DONER

COOPER, JOHN SHERMAN (1901-), a Kentucky Republican, served in the United States Senate for more than 20 years between 1946 and 1973. In the Senate, Cooper strongly supported arms control legislation and opposed U.S. involvement in the Vietnam War. He was coauthor of the Cooper-Church amendment, which prohibited the use of U.S. ground combat forces in Cambodia without congressional approval. In 1974, Cooper became the first U.S. ambassador to East Germany.

Cooper was elected to the Senate in 1946, 1952, and 1956 to fill vacancies resulting from resignations or deaths. He won election to full terms in 1960 and 1966. Cooper served as U.S. ambassador to India and Nepal in 1955 and 1956. He was a member of the Kentucky house of representatives from 1928 to 1930 and a circuit judge from 1930 to 1938. He was born in Somerset, Ky. THOMAS D. CLARK

COOPER, LEROY GORDON, JR. (1927-), a United States astronaut, was the first person to make two orbital space flights. Virgil I. Grissom made two space flights before Cooper did, but Grissom did not orbit the earth during his first flight.

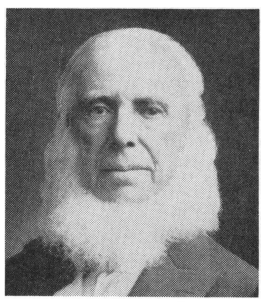
On May 15-16, 1963, Cooper circled the earth 22 times in the Mercury spacecraft *Faith 7*. He and Charles Conrad, Jr., orbited the earth 120 times on Aug. 21-29, 1965, in the Gemini 5 spacecraft. Gemini 5 was the first spacecraft with *fuel cells*, devices that produce electricity from the chemical reaction between a fuel and oxygen. The flight lasted 190 hours 56 minutes and proved that men could live in a weightless state for the length of a trip to the moon.

Cooper was born in Shawnee, Okla. He attended the University of Hawaii from 1946 to 1949. Cooper received an Army commission through the university's ROTC program but transferred the commission to the Air Force. He graduated from the Air Force Institute of Technology in 1956 and became a test pilot in 1957. Cooper was selected as one of the seven original astronauts in 1959. He resigned from the astronaut program in 1970 and entered private business. WILLIAM J. CROMIE

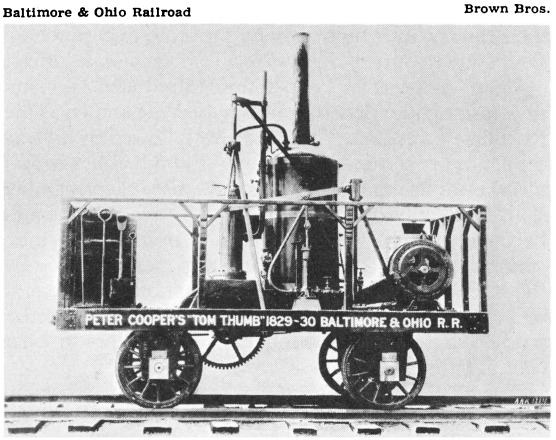
COOPER, PETER (1791-1883), an American inventor, manufacturer, and philanthropist, built the first American steam locomotive to operate on a commercial railroad. He also played an important part in developing the American iron industry. Cooper helped Cyrus Field lay the underseas Atlantic Cable, and founded the Cooper Union for free instruction in art and science.

Cooper began earning a fortune in the 1820's, when he successfully manufactured glue, isinglass, and gelatin. He remained in this business all his life. By 1830, when he built the famous locomotive, "Tom Thumb," he also operated an ironworks in Baltimore (see TOM THUMB). He pioneered in the manufacture and sale of structural iron beams. His son, Edward, and his son-in-law, Abram Hewitt, helped him. During the 1850's and 1860's, Cooper helped promote telegraph and cable companies.

Throughout his life, Cooper took an active interest



Brown Bros.



Baltimore & Ohio Railroad

The *Tom Thumb*, *below*, was the first steam locomotive to operate commercially in America. Peter Cooper, *right*, completed it in 1830. He raced it against a horse-drawn car. But *Tom Thumb* lost when a power belt slipped off.

in civic affairs. He worked effectively for public education, improved water supplies, and better police and fire protection. After the Civil War, he strongly supported political and social reforms. He ran for President when 85 on the Greenback ticket. Cooper published the book *Ideas for a Science of Good Government* (1883).

Cooper was born in New York City, but spent his youth in Peekskill, N.Y. He soon showed a talent for mechanics and invention. Although he had only a limited education, he received a practical training by helping his father in hatmaking, brewing, and other trades. At 17, he was apprenticed to a coachbuilder, and he later worked as a mechanic. ROBERT H. BREMNER

See also RAILROAD (History).

COOPER UNION. See UNIVERSITIES AND COLLEGES (table).

COOPERATIVE, *koh AHP ruh tihv,* is a business enterprise, jointly owned by a group of persons and operated without profit for the benefit of the owners.

There are several types of cooperatives. Some are for the purpose of selling goods produced by the members of the organization. These are often called *marketing cooperatives.* Others are for the purpose of buying goods to resell to members, and sometimes to the general public as well. These are called *consumer* or *farmer-purchasing cooperatives.* Still others furnish loans (see CREDIT UNION), provide apartment housing at cost, produce goods, or perform various other services.

Men have worked together to gather crops and to produce goods since earliest times. Some men have claimed that all should share the benefits of their work on an equal basis. Others point out that nearly every time such a scheme has been tried, the workers tend to lose initiative and to become lazy and dissatisfied. Robert Owen, a British factory owner of the late 1700's and early 1800's, was the first person in modern times to experiment with a business organized for the benefit of workers and consumers. He had little success. In the same period, William King, a British physician, recommended that workers own their machines.

Chief Kinds of Cooperatives

Consumer Cooperatives. The modern consumer-cooperative movement started in Rochdale, England, on Dec. 21, 1844, when 28 poor weavers opened a tiny grocery store on Toad Lane. Each put a pound sterling of their money in a fund to rent the store and purchase flour, sugar, butter, and oatmeal, at wholesale prices.

These pioneers in cooperation introduced cooperative business practices which have become known as the Rochdale Principles. These are now followed by all true cooperative organizations. One of the principles is that membership should be open to all. Also, each member shall have only one vote, no matter how many shares he owns. The purpose of this is to insure democratic control. Another principle is that any money earned by the business be given back to the members in the form of a saving. The rules also limit the amount of interest paid on shares of stock. Frequently it is limited to 4 per cent. Trading is on a cash basis.

The Rochdale store grew until its membership totaled over 45,000 and its capital to over half a million pounds. The movement has since spread to other parts of the world. The central cooperative organizations are united in an International Cooperative Alliance.

Marketing Cooperatives grade, process, and sell farm produce for the highest price. Each member contributes money to help finance the association. The cooperative pays returns to the farmer according to the amount of produce he sells through the organization. These cooperatives also offer many services which they can perform more easily than the farmer can. Among them are packing, storing, trucking, advertising, and testing.

Marketing cooperatives generally specialize in the handling of a single product. There are separate cooperatives for wheat, cotton, dairy products, livestock, tobacco, wool, citrus fruits, or poultry.

Cooperatives in the United States

Consumer, *marketing*, and *service* cooperatives are among the principal types in the United States. New York and Connecticut had "associated or cooperative dairying" as early as 1810. Cooperative cheese factories started in New York in 1850. Similar organizations started in Wisconsin and Illinois in the next 10 years.

The National Grange and Farmers' Alliance promoted cooperatives. By 1890, farmers had about 1,000 cooperatives. The Farmers Educational and Cooperative Union, begun in 1901, and the American Farm Bureau Federation, founded in 1920, have both supported cooperation. Manufacturing cooperatives have been set up, with the workers owning and controlling their factories, but have not been very successful.

For many years, small individual groups in the United States have employed cooperative methods for purchasing. Labor and farm organizations, such as the Knights of Labor and the Grange, have at times sponsored cooperative stores. Immigrant groups, particularly the Finns, Swedes, Bohemians, and Slavs, brought their ideas on consumer cooperation and used them.

Growth of Consumer and Farmer-Purchasing Cooperatives. After World War I, many farmers in the United States received low prices for their products and paid high prices for their purchases. This situation resulted in a rapid development of farmer-purchasing cooperatives among farmers. They first purchased feed, seed, and fertilizer from wholesalers and distributed them among themselves. Many farmers found that by owning their warehouses and factories they could get better service at a saving. Some cooperatives began to distribute oil and petroleum products. A number of farmers also started to purchase their groceries and household supplies through consumer cooperatives.

Membership in consumer and farmer purchasing cooperatives is more than $2\frac{1}{2}$ million. Their total business amounts to over $2 billion a year. Consumer cooperatives co-ordinate their work through the Cooperative League, founded in 1916. Farmers purchase about a fifth of their supplies through cooperatives.

At the end of World War II, the 2,500 cooperative stores in the United States supplied merchandise to about half a million families. Over half of these stores specialized in groceries with the uniform "Co-op" label and grading. The labels indicate government grading of the food product according to its quality. Cooperative grocery stores are found in all parts of the United States. The stores purchase through a central business organization called National Co-operatives, Inc.

This organization also serves cooperatives in Canada.

One of the greatest advances in cooperative purchasing has been in oil. Cooperatives now market 16 per cent of all rural petroleum products. They own more than 20 oil refineries, 1,000 miles (1,600 kilometers) of pipelines, and 2,000 oil wells. Over 1,500 cooperative service stations furnish gasoline and oil to about half a million families.

Growth of Marketing Cooperatives. Two general types of marketing cooperatives exist in the United States. One is the combined, or federated, type. This consists of an association of previously independent cooperatives. The local units own the stock, elect directors, and control the federation. The other type is an association which serves an entire region from one central office. It may operate over a large territory. Each member signs a contract to deliver his produce to his local shipping point. Many of the national federations and regional associations belong to the National Council of Farmer Cooperatives. Its headquarters are in Washington, D.C. It represents 5,000 local cooperative associations and about 2,600,000 patrons.

The federal government encourages marketing cooperatives. The Farmer Cooperative Service of the United States Department of Agriculture also assists them. The Farm Credit Act of 1933 provided for the establishment of twelve Banks for Cooperatives which make loans to these organizations. The Capper-Volstead Act of 1922 made it clear that they did not violate the antitrust laws, and defined their legal basis. But cooperatives are subject to the same trade regulations governing other business organizations, groups, or individuals.

Service Cooperatives. About half a million families have insured their lives and automobiles through cooperatives. Mutual insurance companies have insured property for millions of U.S. families. More than 2 million farms get light and power from cooperative rural electric associations. Cooperative methods are also used in housing, telephone service, banking, medical care, burial associations, loan societies, and camps.

Cooperatives Throughout the World

European Cooperatives. Wherever people have been allowed to establish free institutions, cooperatives have appeared. In Sweden, they compete with both the giant privately owned companies and with government control, and hence are often referred to as the "middle way." Their business amounts to about 15 per cent of the total retail trade. They charge low prices and return only small refunds to members. This policy has enabled them to lower the prices of many products. The cooperatives of Finland do about 40 per cent of the total retail business of the country. Almost 90 per cent of the farm marketing is cooperative in Denmark.

About 11 million people belong to cooperatives in Great Britain. Their stores range in size from tiny shops to those with business amounting to millions of dollars. The local societies are federated into huge regional organizations supplying goods at wholesale. They own factories, farms, plantations, and an ocean-going fleet.

Canadian Cooperatives. In Canada, the marketing of wheat takes place through large cooperative wheat pools. They were first organized in 1923 in Alberta as a result of needs that arose during World War I. Farmers made contracts for a period of five years to deliver all their wheat to be sold through the pool. Over one-fourth of the people of Saskatchewan are members of such wheat pools. Farm and household equipment, oil and gasoline, and many other products are sold through cooperatives in Canada. C. Maurice Wieting

Related Articles in World Book include:

Consumer Protection
Farm Credit Administration (Banks for Cooperatives)
Farmer Cooperative Service
Farmers Union, National
Food (The Food Industry)
Grange, National
Housing (Cooperative Housing)
Owen (family)

COOPERATIVE ALLIANCE, INTERNATIONAL. See Cooperative (Consumer Cooperatives).

COOPERSTOWN, N.Y. (pop. 2,403), is a resort village on Otsego Lake, about 80 miles (130 kilometers) west of Albany. William Cooper visited the site in 1785 and settled there in 1790. His son, James Fenimore Cooper, set two of his famous *Leatherstocking Tales* in the region.

Cooperstown is the home of the National Baseball Hall of Fame and Museum, which was established in 1939. Many people then believed that baseball had been invented in Cooperstown by Abner Doubleday in 1839 (see Baseball [The Abner Doubleday Theory]; Doubleday, Abner). Fenimore House, a historical museum, also attracts many visitors. William E. Young

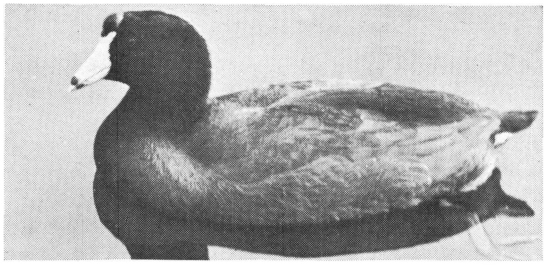
National Baseball Library

The National Baseball Hall of Fame and Museum, in Cooperstown, N.Y., displays bats and gloves of famous players.

COORDINATES. See Algebra (Functions).

COOSA RIVER is formed by the junction of the Oostanaula and Etowah rivers near Rome, Ga. The Coosa flows west and south until it joins the Tallapoosa River north of Montgomery, Ala., to form the Alabama River. For location, see Alabama (physical map). The river is 300 to 500 feet (91 to 150 meters) wide, and drops about 450 feet (137 meters) during its 286-mile (460-kilometer) course. The Alabama Power Company has built several dams on the river. J. Allen Tower

COOT, or Mud Hen, is a dark gray water bird that looks like a duck. The American coot lives in southern Canada, the United States, Mexico, and South America. The European coot is sometimes seen in North



Allan D. Cruickshank

The Coot Is More at Home in Water than on Land.

America. The name *coot* is also used for about six kinds of wild ducks.

The coot is from 13 to 16 inches (33 to 41 centimeters) long, and weighs about 1 pound (0.5 kilogram). Most of its body is dark, with a white patch under the tail. Its large, clumsy feet have lobes or scallops for swimming. The saying *silly as a coot* probably comes from the bird's clumsiness.

Scientific Classification. The American coot belongs to the rail family, *Rallidae*. It is genus *Fulica*, species *F. americana*. The European coot (or mud hen) is classified as *F. atra*. GEORGE J. WALLACE

COOTIES, MILITARY ORDER OF THE. See VETERANS OF FOREIGN WARS OF THE UNITED STATES.

COP. See POLICE (In the United States).

COPAL. See TALLOW TREE.

COPENHAGEN, *KOH p'n HAY gun* (pop. 625,678; met. area 1,384,411), is Denmark's capital and largest city. Its official name is København. Old parts of the city lie on the east coast of the island of Sjælland, at the head of a harbor which gave the town its early name of *Købmandehavn* (Merchant's Harbor). Its suburbs occupy part of the island of Amager, just east of Sjælland. The city is as far north as Moscow, but winds blowing across the North Sea make its climate milder.

Appearance. Copenhagen is an old city crowded with new buildings of stone and concrete. It has an airport, factories, railroads, and wide boulevards. Narrow cobblestone streets lined with gabled houses twist through the older sections of the city.

Authenticated News

Copenhagen's Rådhusplads is a large square in the heart of the city. The city hall faces the square on the right.

Copenhagen and its suburbs have more than a fourth of Denmark's population. More than half the country's shipping passes through its harbor. Exports include manufactured articles such as lace, needlework, and Copenhagen's famed porcelain and silverware. Fishing boats line the harbor, and live fish are sold in the markets.

Copenhagen has many parks, statues, fountains, and beautiful buildings, some of them dating back to the 1600's. The *Børsen* (Exchange), built in the early 1600's, has a spire shaped like four great dragons whose tails twine up to the peak. Four palaces are set around a great, open square. One of them is the home of the king of Denmark. Nearby is the Marble Church, begun by Frederik V in 1749. Its dome is almost as large as the dome of St. Paul's in London. In the Bispebjerg area is a church built in memory of Nikolai F. S. Grundtvig, a Danish theologian and poet. The University of Copenhagen, founded by Christian I in 1479, is one of the oldest universities in Europe.

History. The history of Copenhagen was the history of Denmark for many years, because the country centered around the town. In 1043, Copenhagen was a fishing village. By the 1100's it had grown into a town because of the trade through its fine natural harbor. In 1416, Copenhagen became the capital of the country. Part of the early wealth of Copenhagen came from duties put upon ships that sailed through the straits between Denmark and Sweden. The city stood firm against an attack by Swedish forces under King Charles X from 1658 to 1659, against an English bombardment in 1807, and against various other enemy attacks. German troops occupied Copenhagen from 1940 to 1945. JENS NYHOLM

See also DENMARK (pictures; map).

COPEPOD is a small crustacean of the order *Copepoda*. Copepods may live in fresh or sea water. They are part of the *plankton*, or mass of small organisms that drift near the surface of water. They serve as an important part of the diet of many fish, especially herring.

See also CRUSTACEAN; PLANKTON; ANIMAL (color picture: Animals of the Oceans).

COPERNICUS, *koh PUR nih kuhs*, **NICOLAUS** (1473-1543), was a Polish astronomer who developed the theory that the earth is a moving planet. As a result, he is considered the founder of present-day astronomy.

In Copernicus' time, astronomers accepted the theory Ptolemy had formulated 1,400 years earlier. Ptolemy had said the earth was the center of the universe, and had no motion. He also thought that all the observed motions of the heavenly bodies were real.

But Copernicus doubted Ptolemy's theory. Copernicus believed that the earth hurtles rapidly through space. Man does not sense this motion because he travels with the earth. As a result, some of the motions described by Ptolemy did not occur. What man sees in the heavens is affected by the earth's motion. Real motions in the heavens must be separated from apparent motions.

Copernicus skillfully applied this new idea in his masterpiece, *Concerning the Revolutions of the Celestial Spheres* (1543). In this book, Copernicus demonstrated how the earth's motions could be used to explain the movements of other heavenly bodies. Copernicus' theory also laid the foundations for the telescopic discover-

ies of Galileo, the planetary laws of Johannes Kepler, and the gravitation principle of Sir Isaac Newton.

Copernicus was born in Thorn (now Toruń, Poland). In Polish, his name was Mikołaj Kopernik. He attended Jagiellonian University of Kraków. Through the influence of his uncle, a bishop, Copernicus was appointed a canon of the cathedral chapter of Frauenburg (now Frombork, Poland). The income from this position supported him for the rest of his life. The chapter gave him permission to continue his education in Italy. Copernicus received a doctor's degree in law from the University of Ferrara. He also studied medicine at the University of Padua.

When he returned to Poland, he acted as medical adviser to his uncle and served as canon. EDWARD ROSEN

See also GALILEO; KEPLER, JOHANNES; PTOLEMY.

COPLAND, *KOHP luhnd,* **AARON** (1900-), is an American composer who has written in many styles and forms. He won the 1945 Pulitzer prize for music for the ballet *Appalachian Spring* (1944). In 1949, he received an Academy Award for his music for the motion picture *The Heiress* (1948).

Several of Copland's early works show the influence of French and middle European music of the early 1900's. He also emphasized jazz in such early works as *Music for the Theater* (1925) for small orchestras. From the mid-1930's to the mid-1940's, Copland incorporated folk music into his compositions. *El Salón Mexico* (1937), an orchestral work, uses traditional Mexican themes. Copland's music for the ballets *Billy the Kid* (1938) and *Rodeo* (1942) includes folk songs of the American West. Copland blended elements of his earlier styles in his *Symphony No. 3* (1946). Beginning in the early 1950's, he revived the "atonal" style found in some of his earlier works. His work during this period includes *Piano Fantasy* (1957).

Copland was born in New York City. His parents were Russian Jews, and he used Jewish themes in such compositions as *Vitebsk* (1929) for cello, piano, and violin. Copland has written several books in an effort to promote wider acceptance of modern music. These books include *What to Listen for in Music* (rev. ed. 1964) and *The New Music, 1900-1960* (rev. ed. 1968). JAMES SYKES

COPLEY, JOHN SINGLETON (1738-1815), is generally considered the greatest portrait painter in colonial America. His many superb portraits capture the character of Americans in settings of everyday life. He painted with remarkable directness and vitality, making rich use of color, texture, and light and shade.

Copley was born in Boston. In 1766, he sent *Boy with a Squirrel* to a London exhibition. The painters Sir Joshua Reynolds and Benjamin West praised this charming portrait and recommended that Copley study in Europe. Copley was having great success in America, so he put off going to London until 1774. He settled there permanently, and his portraits soon took on the brilliant brushwork and rich atmospheric quality characteristic of British painting.

In 1778, Copley began a career as a painter of historical subjects, fulfilling a lifelong ambition. He painted many historical works, but only two of them—*Watson and the Shark* (1778) and *The Death of Lord Chatham* (1781)—were successful. After 1781, Copley's work gradually declined. In old age, he longed to return to America, but remained in London until his death.

In the past, critics praised Copley's straightforward, vivid American portraits and were critical of the lavish portraits and large historical paintings he did in England. Today critics still praise his American works, and they view his English works with less disfavor than in the past. EDWARD H. DWIGHT

See also HANCOCK, JOHN (picture).

National Gallery of Art, Washington, D.C., Andrew W. Mellon Fund

Copley's Family Portrait was painted in 1776. The picture shows Copley, his wife and their four children, and the artist's father-in-law. Copley's careful composition and his delicate handling of color make this one of his finest paintings.

COPPER

COPPER (chemical symbol, Cu) has been one of man's most useful metals for more than 5,000 years. Today, the uses of this reddish-orange metal range from rain gutters for houses to electronic guidance systems for space rockets.

Copper is the best low-cost conductor of electricity. As a result, the electrical industry uses about six-tenths of the copper produced, chiefly in the form of wire. Copper wire carries most of the electric current for homes, factories, and offices. Large amounts of copper wire are used in telephone and telegraph systems, as well as in television sets, motors, generators, and other kinds of electrical equipment and machinery.

Combined with other metals, copper forms such alloys as brass and bronze (see BRASS; BRONZE). Copper and its alloys can be made into thousands of useful and ornamental articles. In the home, copper serves as the basic material for lighting fixtures, locks, pipe, plumbing fixtures, doorknobs, drawer pulls, candlesticks, and clocks. Other commonly used copper products include lamps, mailboxes, pots, pans, and jewelry. Perhaps the most familiar copper objects are pennies.

Chemical compounds of copper help improve soil and destroy harmful insects. Copper compounds in paint help protect materials against corrosion. Also, copper in small amounts is vital to all plant and animal life.

In ancient times, the chief source of copper for the peoples near the Mediterranean Sea was the island of Cyprus. As a result, the metal became known as *Cyprian metal*. Both the word *copper* and the chemical symbol for the element, *Cu*, come from *cuprum*, the Roman name for Cyprian metal.

Properties of Copper

The physical characteristics of copper make it a valuable industrial material. These include (1) conductivity, (2) malleability, (3) ductility, and (4) resistance to corrosion.

Conductivity. Copper is perhaps best known for its ability to conduct electricity. Silver is the only better conductor, but silver is too expensive for common use. Copper alloys do not conduct electricity nearly as well as pure copper. Impurities in refined copper also greatly reduce electrical conductivity. For example, as little as $\frac{5}{100}$ per cent arsenic cuts the conductivity of copper by 15 per cent. Copper is also an excellent conductor of heat. This property makes it useful in cooking utensils, radiators, and refrigerators.

Malleability. Pure copper is highly *malleable* (easy to shape). It does not crack when hammered, stamped, forged, die-pressed, or spun into unusual shapes. Copper can be *worked* (shaped) either hot or cold. It can be rolled into sheets less than $\frac{1}{500}$ inch (0.05 millimeter) thick. Cold rolling changes the physical properties of copper and increases its strength.

Ductility. Copper possesses great *ductility*, the ability to be drawn into thin wires without breaking. A copper bar 4 inches (10 centimeters) square can be heated, rolled, and drawn into a round wire thinner than a human hair. Such a wire would be more than 20 million times longer than the bar used to make it.

Resistance to Corrosion. Copper is quite resistant to corrosion. It will not rust. In damp air, copper turns from a reddish-orange to a reddish-brown color. After long exposure, copper becomes coated with a green film called *patina*. The patina protects the copper against further corrosion.

Other Properties. Copper has an atomic number of 29, and an atomic weight of 63.54. It melts at 1083° C (±0.1° C), and boils at 2595° C. Copper has a density of about 560 pounds per cubic foot (8,970 kilograms per cubic meter) and a specific gravity of 8.92 (see DENSITY; GRAVITY, SPECIFIC). It is about 14 per cent heavier than iron. Cold-rolled copper has a tensile strength from 50,000 to 70,000 pounds per square inch (3,500 to 4,900 kilograms per square centimeter). Copper keeps its strength and toughness up to a temperature of about 400° F. (204° C).

Copper Ores

Most copper comes from about seven kinds of ores. These ores also may contain other metals, such as lead, zinc, gold, cobalt, platinum, and nickel. Copper ores usually contain less than 4 per cent copper. Some ores may yield as little as 0.2 per cent of copper.

The chief copper ores are *sulfides* (sulfur compounds). They include bornite; chalcocite, or copper glance; and chalcopyrite, or copper pyrites. *Oxidized ores*, such as azurite, cuprite, and malachite, also yield valuable amounts of copper. Almost pure copper, called *native* copper, rarely occurs in nature. It supplies only a small percentage of the world's total copper production.

Sources of Copper

Over $6\frac{1}{2}$ million short tons (5.9 million metric tons) of copper are mined each year throughout the world. Every continent has copper deposits. Much of the world's copper comes from the mountain ranges extending from Alaska to the tip of South America.

In some places, miners dig copper ore from mines far below the earth's surface. Elsewhere, they remove it from great open pits at the surface. In *open-pit* mining, large power shovels or other machines remove the ore from wide "steps" 40 to 70 feet (12 to 21 meters) high. Most copper in the United States comes from open pits. See MINING (Kinds of Mining; picture).

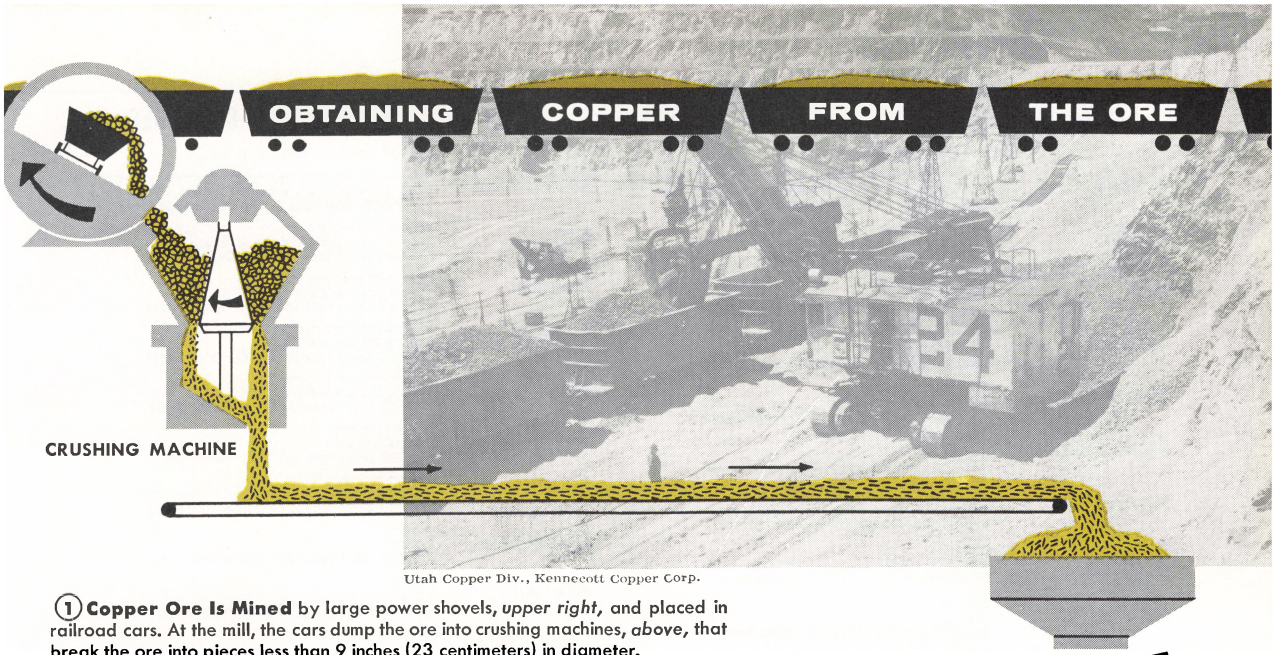
The United States mines about a fourth of the world's copper. But it uses more copper than it mines, and imports large amounts from such countries as Canada and Peru. About half the copper mined in the United States comes from Arizona. The Keweenaw Peninsula in Michigan is one of the few remaining sources of native copper.

Canada mines about 10 per cent of the world's copper. Most of it comes from Ontario and Quebec. The Sudbury district in Ontario has the largest deposits in Canada. British Columbia, Manitoba, Newfoundland, and Saskatchewan also produce important amounts of copper.

Other Areas. Chile, Zambia, and Russia are also important copper producers. Large mines in northern and central Chile provide most of the nation's copper. Zambia has major copper mines along its border with Zaire. Russian copper deposits lie chiefly in the Ural and Caucasus mountains and in the state of Kazakhstan. Zaire

Frank R. Milliken, the contributor of this article, is president of Kennecott Copper Corporation.

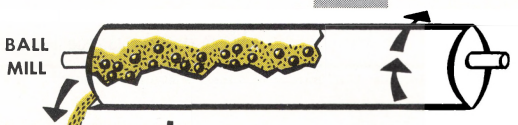
OBTAINING COPPER FROM THE ORE



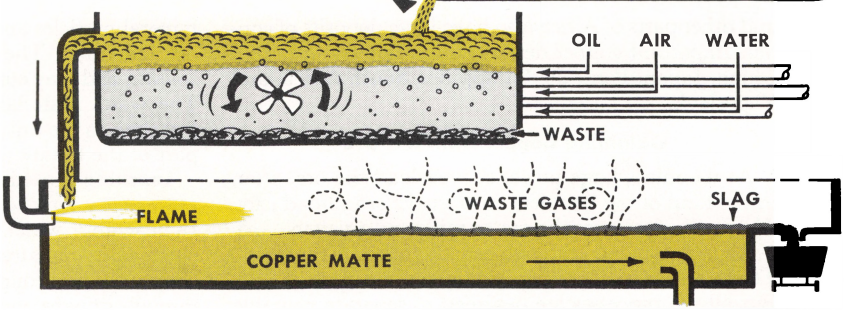
Utah Copper Div., Kennecott Copper Corp.

1 Copper Ore Is Mined by large power shovels, *upper right,* and placed in railroad cars. At the mill, the cars dump the ore into crushing machines, *above,* that break the ore into pieces less than 9 inches (23 centimeters) in diameter.

2 The Ball Mill processes a souplike mixture of copper ore called *slurry.* Iron balls inside a rotating drum grind the ore into fine dustlike particles.

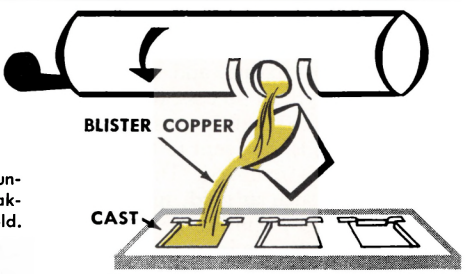


3 Flotation Cells concentrate the copper from the ball mill. Chemicals bring the copper minerals to the top to be scraped off and dried.

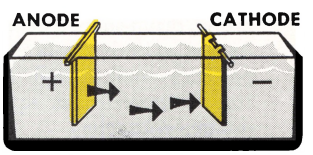


4 The Reverberatory Furnace shoots flames above the copper material. Impurities rise to the top and form a *slag* that is drained off.

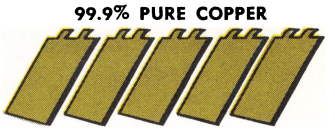
5 The Converter finally reduces the original ore to metallic copper. After the slag is drawn off, the remaining *blister copper* is more than 97 per-cent pure.



6 Blister Copper is cast into the anodes used in electrolytic refining.



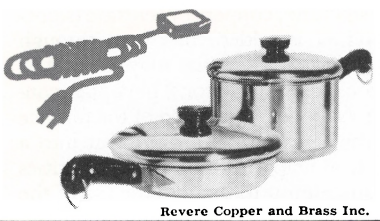
7 Electrolytic Refining produces 99.9 per-cent pure copper. An electric current causes the copper on the anodes to deposit on the cathodes.



PROPERTIES OF COPPER

CONDUCTIVITY

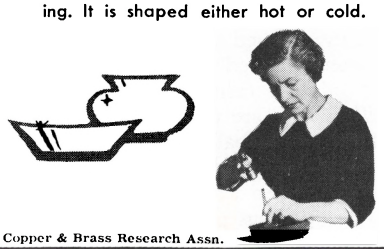
Copper's ability to conduct heat and electricity makes it useful in pots, pans, and electrical wiring.



Revere Copper and Brass Inc.

MALLEABILITY

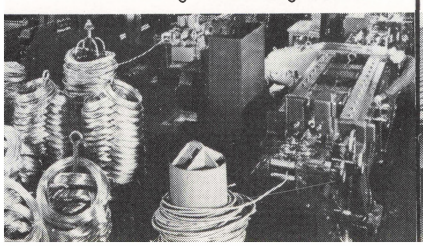
Copper is easily hammered into unusual shapes without cracking or breaking. It is shaped either hot or cold.



Copper & Brass Research Assn.

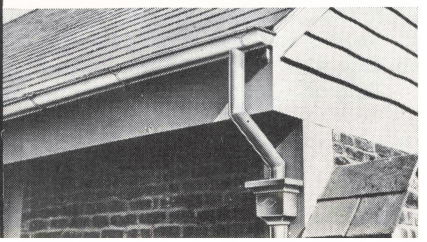
DUCTILITY

Copper is drawn into thin wires and rods that withstand great stresses without breaking or becoming weaker.



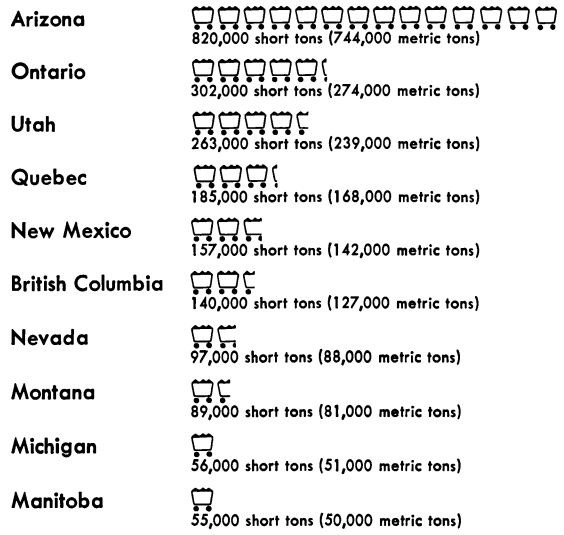
RESISTANCE TO CORROSION

Copper is ideal for materials that touch water, such as downspouts, because the metal does not rust.



LEADING COPPER-MINING STATES AND PROVINCES

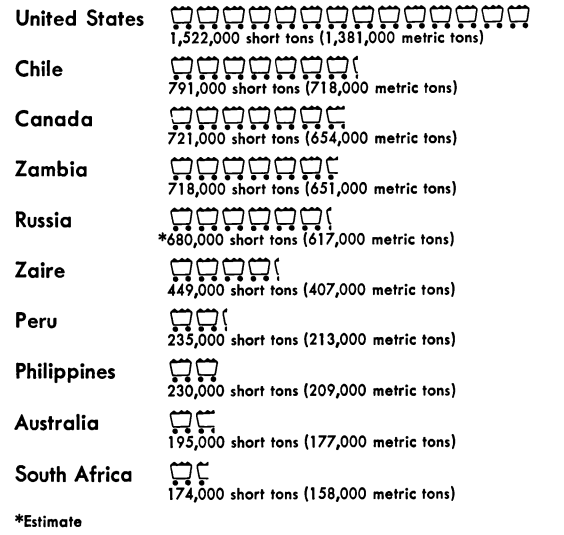
Tons of copper mined in 1971



Sources: U.S. Bureau of Mines; Statistics Canada

LEADING COPPER-MINING COUNTRIES

Tons of copper mined in 1971



*Estimate

Sources: U.S. Bureau of Mines; Statistics Canada

and other parts of Africa also have large deposits of copper. Important copper deposits also occur in Australia, China, Japan, Peru, the Philippines, South Africa, and Yugoslavia.

Obtaining Copper from the Ore

At the mine, large power shovels load the ore, often in the form of big boulders, into trucks or railroad cars. These vehicles carry the ore to mills and smelters.

All ores do not go through exactly the same processes. There are variations, depending on the type of ore. But all the processes are designed to separate valuable minerals from the ore and waste rock, to extract copper and any other metals that may be present in the resulting mixture, and to purify the metals produced.

In a typical process, the ore is sent to the mill, where it is crushed and the waste rock removed. The resulting material is then sent to the smelter, where the metallic copper is removed. This copper may contain other metals, such as gold, silver, and nickel, that must be removed by refining.

Milling starts in a *concentrator*, where the crushed ore is ground into fine particles. Then water is added to the crushed ore to form a souplike mixture called *slurry*. The slurry passes into *ball mills*, which are rotating, drum-shaped cylinders half-filled with iron balls. As the cylinders rotate, the balls grind the ore into particles small enough to pass through a screen with 10,000 openings per square inch (1,600 openings per square centimeter).

The slurry next goes through a *flotation process* that concentrates the mineral-bearing particles. The slurry first passes into containers called *flotation cells*. There, chemicals and oil are added, and the entire mixture is agitated by paddles or air jets to make it bubble. One chemical makes the bubbles stable. Another chemical coats the mineral particles so that they stick to the bubbles. The bubbles rise to the top of the cell with the mineral particles and form a froth. This froth is scraped off and dried. The product is now called *copper concentrate*, and may contain from 15 to 33 per cent copper. The waste material, called *tailings*, does not become attached to the bubbles, and is emptied from the lower part of the flotation cell.

Leaching is used to recover copper from ores that do not react to the chemicals used in the flotation process. In leaching, water containing sulfuric acid or other chemicals circulates through the ore and dissolves the copper. The copper-bearing solution then passes through troughs containing pieces of iron. Some of the iron dissolves, and replaces the copper in the solution. The copper is deposited on the remaining pieces of iron. From time to time, the pieces of iron are agitated and washed to remove the copper, and more iron is added as needed. Copper obtained by leaching is called *precipitate copper*, and is from 60 to 90 per cent pure. Such copper is usually smelted and refined. But it is sometimes sold for use without further refining.

Smelting removes most of the remaining impurities from the copper. In smelting, copper concentrate (sometimes precipitate copper is added) first goes through a *reverberatory furnace*. Such a furnace may process as much as 350 short tons (318 metric tons) of copper concentrate at one time. A firebox at one end of the furnace shoots flames over the concentrate, changing it into a bubbling mass. The heat helps drive off some impurities in the form of gas. Other impurities rise to the top of the molten mass to form *slag*, which consists mostly of iron, lime, and silica. The slag is skimmed off and discarded. The new mixture, called *copper matte*, contains from 25 to 50 per cent copper. It still has impurities in the form of iron sulfide and other metals.

The copper matte next goes through a *converter*. In the converter, blowers force air through the molten copper matte, and silica is added. The silica combines with the impurities, forming slag. The slag is again

skimmed from the top. The new mixture is called *blister copper*, because the surface blisters as the copper cools. Blister copper is from 97 to 99.5 per cent pure.

When blister copper does not contain significant amounts of gold or silver, it may be refined in a *fire-refining furnace*. This furnace removes most of the remaining impurities, mainly oxygen. In a process called *poling*, workers force green pine logs into the *melt* (furnace load) of molten copper. The logs create a blazing, bubbling turmoil in the hot copper. As the logs burn, oxygen and other gases are removed from the copper. The resulting copper is 99.9 per cent pure.

Electrolytic Refining. Copper to be used in electrical conductors must be electrolytically refined to a purity of more than 99.9 per cent. To do this, blister copper is cast into cakes about 3 feet (91 centimeters) square and 3 inches (8 centimeters) thick. The cakes serve as *anodes* (positive poles) in the electrolytic process. For a discussion of the chemical principles involved in this process, see ELECTROLYSIS.

The copper anodes are put into tanks containing a solution of copper sulfate and sulfuric acid. They are suspended alternately with *cathodes* (negative poles) which are thin sheets of pure copper called *starter sheets*. When an electric current passes through the tank, the anode bars gradually dissolve, depositing copper more than 99.9 per cent pure on the cathodes. Most of the remaining impurities in the anodes settle to the bottom of the tank and form a *sludge*. Processors use various methods to recover small amounts of gold, silver, platinum, and other metals from the sludge. After electrolysis, the copper cathodes are usually melted in an electric furnace, and cast into various shapes and sizes, such as bars, cakes, ingots, and billets.

Making Copper Products

Fabricating plants, such as brass and wire mills, make semifinished forms including sheets, tubes, wires, and rods. They make these forms from copper bars, cakes, ingots, and billets. Manufacturers of copper products buy the semifinished forms from these plants.

Copper Sheets are rolled from copper cakes that measure about 25 inches (64 centimeters) wide, 8 inches (20 centimeters) thick, and up to 72 inches (183 centimeters) long. The cakes are heated in a furnace to about 1700° F. (926° C), then rolled on a hot mill into sheets about $\frac{1}{2}$ inch (13 millimeters) thick. Other mills finish the sheets by rolling them to exact thicknesses. The sheets are then cut into pieces of the required size to make such products as roofing sheets, cooking utensils, and photoengraving plates (see ENGRAVING).

Copper Tubes are made from copper billets that vary in diameter from 3 to 9 inches (8 to 23 centimeters) and are up to 52 inches (132 centimeters) long. Workers heat the billets in a furnace, then pierce them to produce a rough pipe. The pipe shells thus formed are forced through dies and over other devices to produce tubes of the required size. Manufacturers use the tubes to make plumbing pipes, household gas lines, and electrical conduits.

Copper Wire is made from copper bars that measure about 54 inches (137 centimeters) long and 4 inches (10 centimeters) square. After being heated in a furnace, the bars are rolled on a mill to form rods about $\frac{1}{4}$ inch (6 millimeters) thick. The rods are then pulled through the dies of wire-drawing machines. These dies reduce the rods to the desired wire sizes. Most copper wire is used to carry electric current.

Extruded Copper. Some copper is *extruded* (squeezed) through a hole in a die to form the desired shape. Copper can be extruded into rods, tubes, and other special shapes. These are made into hinges, door pulls, and other pieces of hardware.

History

Copper was one of the first metals known to man. It came into use because early peoples found it in native condition and could easily beat it into tools, weapons, and ornaments.

Early Civilizations. Copper was probably first used about 8000 B.C. by people living along the Tigris and Euphrates rivers, where Iraq lies today. As early as 6000 B.C., the Egyptians knew how to hammer native copper into sheets to make tools and ornaments. Copper was later used by many peoples, including the Chinese, the Inca of Peru, and the American Indians.

By about 3500 B.C., men had discovered how to melt and alloy copper with tin to make bronze. At about that same time, they learned to smelt copper from ore. From about 3000 B.C. to about 1100 B.C., bronze became important (see BRONZE AGE). Much later, the Romans used bronze swords. The process of combining zinc with copper to make brass was probably discovered sometime between 1000 B.C. and 600 B.C.

Industrial Developments. From early times until the A.D. 1800's, ample high-grade ore was available, and methods for processing and using copper changed only slightly. By the late 1800's, the rapid growth of electric lighting and telephone and telegraph systems had greatly increased the demand for copper, which dwindling deposits of high-grade ore could not meet. Also, most native copper deposits had been used up.

Geologists had located large ore deposits in the United States and Chile. But the copper content of the ore was so low that the ore could not be processed at a profit. About 1900, a young American mining engineer, Daniel C. Jackling, realized that low-grade ores could be processed cheaply by using mass-production methods. His process involved the use of steam shovels to strip off surface rock. Other special mass-production equipment was used for smelting and refining. New techniques for separating copper from the ore also increased the supply of available copper.

The Kennecott Copper Corporation is the leading copper producing company in the United States. The leading Canadian company is the International Nickel Company, Incorporated.

FRANK R. MILLIKEN

Related Articles in WORLD BOOK include:

COPPER PRODUCTS

Blue Vitriol	Bronze	Verdigris
Bordeaux Mixture	Monel Metal	Wire
Brass	Nickel Silver	

OTHER RELATED ARTICLES

Alloy	Azurite	Lavender Pit
Anaconda	Chalcocite	Malachite
Company	Kennecott Copper	Mineral (picture)
Arizona (Mining)	Corporation	Nevada (picture)

COPPER GLANCE. See CHALCOCITE.

COPPER PYRITES. See COPPER (Copper Ores).

COPPERHEAD is a poisonous American snake, one of the pit vipers. It is also known as the *pilot snake* and *rattlesnake pilot*. Its body has broad chestnut-red bands between coppery red ones. Most copperheads are about $2\frac{1}{2}$ feet (76 centimeters) long. The largest grow to about 4 feet (1.2 meters).

The copperhead bites people more often than the banded and diamondback rattlesnakes, because it is silent and smaller, and is not so quickly noticed. The bite is seldom fatal to adults, but can seriously poison children who weigh less than 75 pounds (34 kilograms). This reptile eats mostly rodents and other small mammals. Sometimes it eats insects and frogs. It usually bears from three to seven young in August or September.

The copperhead lives south of a line from the northeastern tip of Massachusetts through Pittsburgh to the southeastern corner of Nebraska. From there the line passes southwest to the upper Rio Grande in Texas, and then just misses New Mexico. In this area any snake is likely to be called a copperhead if its markings resemble one. But the copperhead can be told from other kinds of snakes in a number of ways. It has no rattle on the tip of its tail. It has a pit in front of and below each eye. The snake's nostril is in front of the pit.

Scientific Classification. The copperhead belongs to the viper family, *Viperidae*. It is genus *Agkistrodon*, species *A. contortrix*. CLIFFORD H. POPE

See also SNAKE (color picture); VIPER.

COPPERHEAD was a name given to Peace Democrats who criticized President Abraham Lincoln's Administration during the Civil War. Loyal Unionists claimed the Copperheads were pro-Southern and reminded them of the poisonous snakes with the copper-colored heads. Copperheads cut the head of Liberty from the copper cent and wore it as a badge.

Copperheads opposed Lincoln's attempts to free the slaves in the South. They spoke out against political arrests and the military draft and favored compromise with the Confederate States to end the war. The movement reached its peak early in 1863. But Union military victories and Republican election victories in 1864 helped to end the Copperhead movement. FRANK L. KLEMENT

See also SONS OF LIBERTY; SEYMOUR, HORATIO; VALLANDIGHAM, CLEMENT L.

COPPIN STATE COLLEGE. See UNIVERSITIES AND COLLEGES (table).

COPRA, *KAHP ruh*, is the dried meat of the coconut. Copra is valuable for its oil, used in the manufacture of soap, candles, and other articles. Copra is one of the main exports of islands in the Pacific. The oil is pressed out after the copra has been dried in the sun, in ovens called *kilns*, or by the use of hot air. The remaining cake, called *coconut-stearin*, is used, like cottonseed-oil cake, for fodder and manure. Copra yields from 50 to 65 per cent of its weight in oil when dried. Hot-air drying sometimes raises production to as much as 75 per cent. Thirty average coconuts produce about 1 gallon (3.8 liters) of oil. See also COCONUT PALM; PACIFIC ISLANDS (picture: Producing Copra). CHARLES L. MANTELL

COPTS, *kahpts*, are members of the Coptic Orthodox Church. The name *Copt* is taken from the Greek word *Aegyptios*, meaning *Egyptians*. The Copts are descended from ancient Egyptians who were converted to Christianity in the A.D. 100's and 200's. The converts developed their own Coptic language. It combined the Greek alphabet with Egyptian vocabulary and symbols. They used the language in religious writings and translations of the Bible. A dialect of this language is still used in the church liturgy, although Arabic is the dominant language spoken today. The Copts originated monasticism, which later spread to other churches.

Spaa, Pix

Monks of the Coptic Church worship daily in their ceremonial robes. Usually, they hold a cross and read from the Coptic Bible.

At first, the *patriarchate* (ruling division) of Alexandria was one of the most powerful in Christendom. But disputes concerning the nature of Christ led to a split between Rome and Alexandria. The Egyptian church adopted a *monophysite doctrine* that asserted the single nature of Christ. In 451, the Council of Chalcedon condemned this doctrine as heresy. The Coptic Church broke away from Rome and Constantinople, and has remained independent under the patriarch of Alexandria. When the Moslems conquered Egypt in 642, many Copts were converted to Islam. Today, about 3,500,000 Ethiopians belong to the Coptic Orthodox Church. About 1,200,000 Egyptians are members. An ancient Coptic community also exists in Jerusalem. KEITH C. SEELE

COPYHOLD. See VILLEIN.

COPYING MACHINE. See DUPLICATOR; PHOTOCOPYING; PRINTING (Electrostatic Printing).

COPYREADER. See JOURNALISM (Journalists at Work).

COPYRIGHT is the legal right an author has to protect his writings against copying. It also extends to dramatic, musical, and artistic works. In the United States, *copyright* usually means *statutory copyright*, a grant of rights by Congress as set forth in the United States Copyright Law. It also means a recognized right not specified in the Copyright Law. This right is called *common-law copyright*. Generally, common-law copyright is in effect before a work is published, and statutory copyright becomes effective after it is published.

Common-Law Copyright. Prior to publication, an author has the sole right to decide what shall be done with his work. No one may publish it without his permission,

unless he sells a copy of his manuscript without restriction or makes his work public without qualifying for statutory copyright. Common-law copyright ends when statutory copyright begins.

Statutory Copyright. Many copyright laws have been enacted in the United States since the first Federal Copyright Act of 1790. The present copyright law was enacted in 1909, *codified* (systematized) in 1947, and later amended. It grants statutory copyrights for 28 years and allows owners to extend the copyright for another 28 years. An applicant must state to which of the following classes the work belongs:

(a) Books, including composite and encyclopedic works, directories, gazetteers, and other compilations.
(b) Periodicals, including newspapers.
(c) Lectures, sermons, addresses for oral delivery.
(d) Dramatic compositions or musical dramas.
(e) Musical compositions.
(f) Maps.
(g) Works of art or models or designs for art works.
(h) Reproductions of a work of art.
(i) Drawings or plastic works of a scientific or technical character.
(j) Photographs.
(k) Prints and pictorial illustrations, including prints or labels used for articles of merchandise.
(l) Motion-picture photoplays.
(m) Motion pictures other than photoplays.
(n) Sound recordings.

Other Privileges. A statutory copyright carries with it the right to print, reprint, publish, copy, sell, and, in some instances, to perform and record the copyrighted work. If it is a literary work, the owner may translate it into other languages or dialects, or make any other version of it. The copyright owner also has the right to arrange or adapt it, if it is a musical composition, and to complete, execute, or finish it, if it is a model or design for a work of art.

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Many European countries are members of the Bern Union, the *Union Internationale pour la Protection des Oeuvres Littéraires et Artistiques.* It has headquarters in Bern (Berne), Switzerland. Any country in the Union grants citizens of any other member country the same rights it gives its own citizens. An author in some other country may obtain these rights by publishing his work first, or at the same time, in a member country.

The United States has joined with several American republics in copyright conventions to protect literary property in the Western Hemisphere. The most important of these conventions was signed at Buenos Aires in 1910. The most recent Inter-American Copyright Convention was signed in 1946. RICHARD G. FERGUSON

See also PATENT; TRADEMARK.

COQUINA. See LIMESTONE.

CORACLE, *KAWR uh kuhl,* is an oval-shaped, basket-like boat. Its frame is made of narrow strips of wood that are covered with canvas or tarred cloth. Coracles are used on the inland waters of Wales and Ireland. The Sioux bull-boat and the *kufa* of Iraq resemble the coracle (see TRANSPORTATION [picture]). ROBERT H. BURGESS

CORAL, *KAWR uhl,* is a limestone formation formed in the sea by millions of tiny animals. Coral formations may look like branching trees, large domes, small irregular crusts, or even like tiny organ pipes. The living coral-forming animals color the formation in beautiful shades of tan, orange, yellow, purple, and green. When the animals die, they leave limestone "skeletons" that form the foundations of barriers and ridges in the sea called *coral reefs.*

Coral reefs look like lovely sea gardens, because many colorful sea animals live among the corals. These animals include fishes, starfish, mollusks, and sea anemones. Sometimes coral masses build up until they rise above the water to form *coral islands.* The grinding, battering sea helps to build coral islands. It breaks up the coral growths and piles them up. Often, soil lodges on the coral and vegetation begins to grow. Many Pacific islands were formed this way.

Coral Reefs are found mostly in warm and tropical seas, because the reef-forming corals cannot live in water colder than 65° F. (18° C). Reefs abound throughout the South Pacific, in the East Indies and the Indian Ocean to Sri Lanka, and around Madagascar on the southeastern African coast. They also form along the tropical eastern coast of Brazil, through the West Indies, along the Florida coast, and at Bermuda. There are three types ot coral reefs: (1) fringing reefs; (2) barrier reefs; and (3) atolls.

Fringing reefs are submerged platforms of living coral animals that extend from the shore into the sea.

Barrier reefs follow the shoreline, but are separated from it by water. They form a barrier between the water near the shore and the open sea. A barrier reef may consist of a long series of reefs separated by channels of open water. Such reefs usually surround volcanic islands of the South Pacific. The Great Barrier Reef of Australia, more than 1,250 miles (2,012 kilometers) long, is the most magnificent coral reef in the world.

An *atoll* is a ring-shaped coral island in the open sea. It forms when coral builds up on a submerged mud-bank or on the rim of the crater of a sunken volcano. The atoll surrounds a body of water called a *lagoon.* One or more channels connect the lagoon to the open sea. Many coral islands of the South Pacific Ocean are atolls.

Coral reefs do not develop on the East Coast of North America north of Florida and Bermuda. But small patches of coral grow as far north as New England. Certain kinds of coral grow as far north as the Arctic Circle.

How Coral Is Formed. The animals that form coral belong to the same animal group as the hydras, jellyfish, and sea anemones. Most individual coral animals, called *polyps,* are less than 1 inch (2.5 centimeters) in diameter, but a small percentage of them measure as much as 1 foot (30 centimeters). A coral polyp has a cylinder-shaped body. At one end is a mouth surrounded by tiny *tentacles.* The other end attaches to hard surfaces on the sea bottom.

Most coral polyps live together in colonies. The *stony corals* attach themselves to each other with a flat sheet of tissue that connects to the middle of each body. Half of the coral polyp extends above the sheet and half below. Coral polyps build their limestone skeletons by taking calcium out of the seawater. Then they deposit *calcium carbonate* (limestone) around the lower half of the body. As new polyps grow, the limestone formation becomes larger and larger.

Coral polyps feed mainly on tiny swimming animals, such as the *larvae* (young) of many kinds of shellfish. Reef corals cannot live without algae. They use some food manufactured by algae that live in the polyps' own tissues. These algae produce chemicals that help the coral animals secrete their limestone skeletons. Coral reefs grow only in water with enough light for photosynthesis to occur in the algae.

Coral polyps reproduce either from eggs or by *budding.* Small, knoblike growths called *buds* appear on the body of an adult polyp, or on the connecting sheet, from time to time. These buds grow larger, separate from the parent, and begin to deposit their own limestone in the colony. Budding helps the colony increase its size. New colonies form when the adult polyps of an old colony produce eggs. The eggs grow into tiny forms that swim away. Then the developing animals settle to the sea bottom and begin to form new colonies by budding.

Various marine animals eat living coral-forming animals. The loss of coral to such animals is usually balanced by the development of new coral colonies and the growth of old ones. But in the 1960's and early 1970's, large numbers of crown-of-thorns starfish destroyed stony coral colonies on many reefs of the southwest Pacific Ocean. Scientists are trying to determine what caused the starfish to become so numerous.

Precious and Gorgonian Corals. Other kinds of coral, in addition to stony corals, are found in the world's oceans. These corals are also colonies of polyps, but the skeletons they form are internal rather than external. *Precious* coral is a *species* (kind) valued for jewelry. It has a hard *core* (internal skeleton) that can be polished. Polishing brings out beautiful red, rose, or pink colors. Craftsmen carve it into beads and other ornaments. Precious coral grows in bushlike formations in the Mediterranean Sea and Sea of Japan.

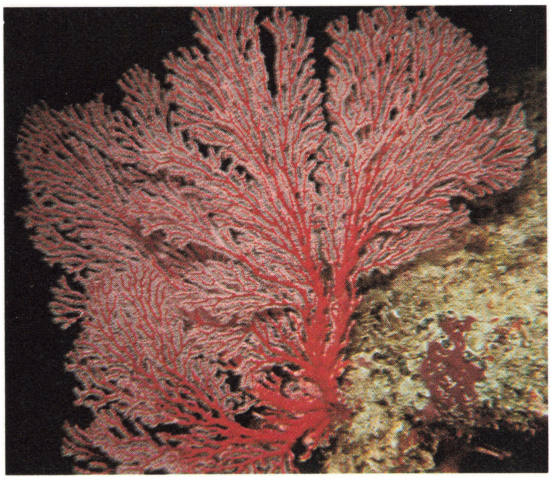
The *gorgonian* corals have internal skeletons of a flexible, horny substance. These corals look like bushes, fans, or whips. They may be soft yellow, rose, purple, brown, tan, or black. In clear West Indian waters, they look like sea gardens as they wave on the reefs.

Scientific Classification. Corals are in the phylum *Coelenterata* and the class *Anthozoa.* ROBERT D. BARNES

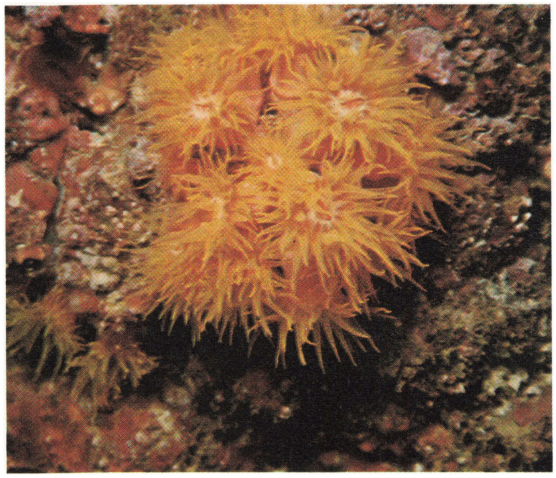
Related Articles in WORLD BOOK include:

Atoll	Bermuda	Limestone
Australia (picture)	Gem (color picture)	Sea Fan
Barbados	Great Barrier Reef	Seashore

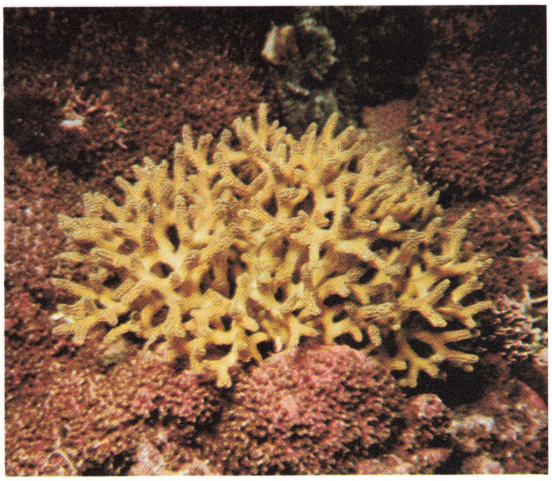
CORAL SEA is the part of the Pacific Ocean between the northeast coast of Australia, the Solomon Islands, and the New Hebrides Islands. It has an unusually large number of coral atolls and bank reefs. The boundaries of this sea are so indefinite that the name could be applied to large parts of the Southern Pacific. The



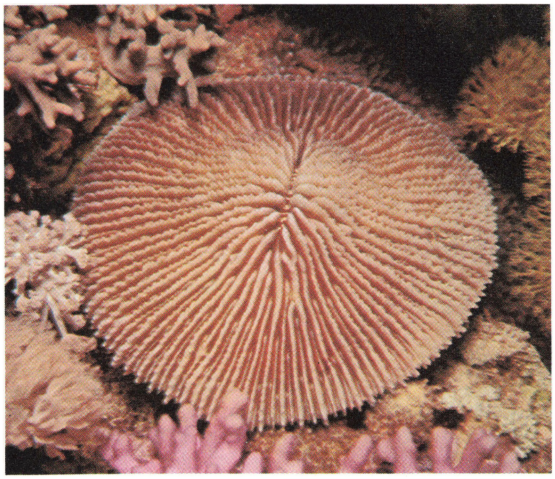
Sea Fan Corals Are Known for Their Bright Colors.



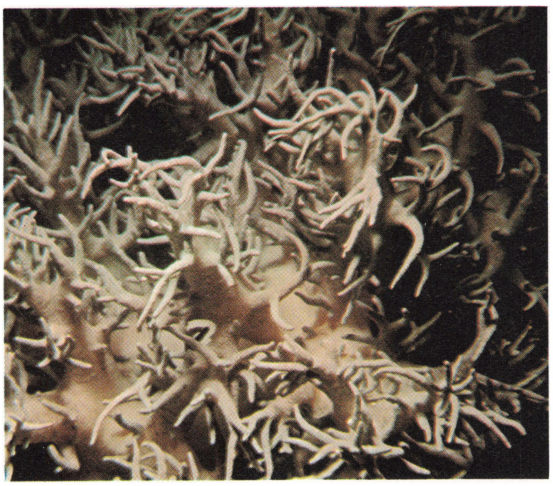
Dwarf Corals Have Brightly Colored Polyps.



Reef-Building Corals Grow in Warm Seas.



Mushroom Corals Are Produced by One Large Polyp.



Soft Corals Look Like Deers' Antlers.

Douglas Faulkner

Lettuce Corals Have a Delicate Leaflike Appearance.

reefs along the western shores of the Coral Sea have the finest specimens of coral (see CORAL).

United States and Japanese naval forces fought a key World War II battle in the Coral Sea. Neither side won a clear-cut victory, but the Japanese offensive was checked for the first time in the war. F. G. WALTON SMITH

See also PACIFIC ISLANDS (color map).

CORAL SNAKE is the name given to several closely related poisonous snakes of the Western Hemisphere. They are found in the southern United States, Mexico, Central America, and tropical South America. Coral snakes have small, blunt heads and bodies.

Coral snakes are poisonous. They do not strike as most other snakes do, but they bite. They are dangerous if stepped on or handled. They are snake eaters.

The *South American* coral snake is about 4 feet (1.2 meters) long. It is common in tropical South America. Its body is made up of circles of bright red separated by rings of dark purple. There are two narrow circles of light yellow in each of the purple ones. The scales are shiny and polished. This snake has a red snout. Behind the snout are a black band and a broad red band.

The *eastern* coral snake, or *harlequin*, generally ranges from 20 to 40 inches (51 to 100 centimeters) in length. It lives in the southeastern United States and in extreme northeastern Mexico. Its body is encircled by broad black and red bands separated by narrow yellow ones. The snake has a black snout. Just behind the snout is a wide yellow band followed by a black band. Some of these coral snakes are covered with black spots that hide much of the red color. Some nonpoisonous snakes look like coral snakes because they have similar coloring. But coral snakes have red and yellow bands next to each other. The harmless snakes have red and black bands together.

The *western*, or *Arizona*, coral snake is about 18 inches (46 centimeters) long. It lives in the lower parts of southern Arizona, in southwestern New Mexico, and in northern Mexico. It also has a black snout. Behind the snout is a white or yellow band followed by a red band.

Scientific Classification. Coral snakes belong to the poisonous land snake family, *Elapidae*. The South American coral snake is genus *Micrurus*, species *M. lemniscatus*. The eastern coral snake is *M. fulvius*, and the western, or Arizona, is *Micruroides euryxanthus*. CLIFFORD H. POPE

See also SNAKE (color pictures).

CORAX. See ORATORS AND ORATORY (Beginnings).

CORBEL. See ARCHITECTURE (Beginnings).

CORBETT, JAMES JOHN (1866-1933), became the world heavyweight boxing champion in 1892. He was regarded as one of the first scientific boxers. A bank teller, Corbett became a professional boxer in 1884, and won the heavyweight title from John L. Sullivan. He lost it to Bob Fitzsimmons in 1897. After trying twice to regain the championship, he retired from the ring and became an actor. Corbett was born in San Francisco, Calif. See also BOXING (picture). LYALL SMITH

CORBUSIER. See LE CORBUSIER.

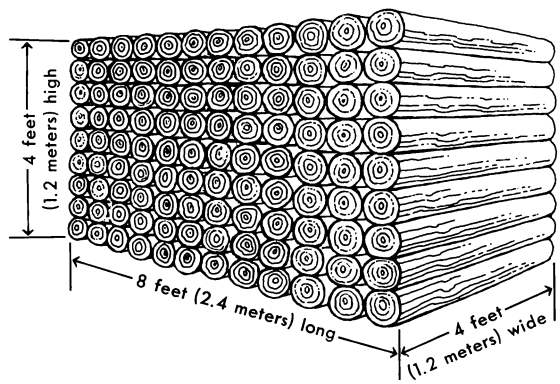
CORCORAN GALLERY OF ART, in Washington, D.C., has collections of paintings, sculpture, drawings, tapestries, and ceramics. It houses one of the world's most important collections of American art, and displays works by Gilbert Stuart, John Singer Sargent, Winslow Homer, and Thomas Sully, among others. The W. A. Clark Collection is devoted to masterpieces from Europe and the Middle East.

The gallery operates an art school offering instruction to about 750 students. It also organizes exhibitions, the most important of which is the Biennial Exhibition of Contemporary American Painting.

William Wilson Corcoran, a banker and philanthropist, founded the gallery in 1859. It is a self-supporting institution. Critically reviewed by the CORCORAN GALLERY OF ART

CORD is a unit for measuring firewood. It is commonly defined as a pile of wood 4 feet (1.2 meters) wide, 4 feet high, and 8 feet (2.4 meters) long. Because fireplaces are smaller than they once were, wood dealers sometimes sell a *face cord*. It has the same height and length as a cord, but its width is only 2 feet (0.6 meters), or some other convenient measure. The cord is not recognized as a legal measure by the United States government. PHILLIP S. JONES

See also WEIGHTS and MEASURES (Wood Measurement [Customary]).



A Cord of Wood Is 128 Cubic Feet (3.6 Cubic Meters).

CORD AND CORDAGE. See ROPE.

CORDAY, *kawr DAY*, **CHARLOTTE** (1768-1793), a French patriot, killed Jean Paul Marat during the Reign of Terror in 1793. She was tried in a Revolutionary court, and, four days later, she was guillotined. She sympathized with the Girondists, a group of representatives in the French legislature (see GIRONDIST). When the Girondist leaders were arrested, Corday resolved to kill Marat, an opponent in the legislature. She obtained an interview with him. While he was in his bath, where he spent several hours each day seeking relief from a skin disease, she stabbed him to death. Charlotte Corday was born in Normandy, France. See also MARAT, JEAN PAUL. RICHARD M. BRACE

Detail of an oil portrait (1793) by Jean-Jacques Hauer; Museé de Versailles, France

Charlotte Corday

CORDIAL. See ALCOHOLIC DRINK (Compounded Liquors).

CORDILLERA, *KAWR duhl YAIR uh,* or *kawr DIHL uhr uh,* is a group of mountain ranges, usually the principal mountain group of a continent. The word cordillera comes from the Spanish word *cuerda,* which means *cord* or *chain.* Spaniards use the word to mean any mountain chain. The term *cordillera* once was used in America to mean only the Andes Mountains. American geographers now use the term to mean any group of mountain systems, such as the western cordillera of North America, which includes the Sierra Madre, the Rockies, the Sierra Nevada, the Cascade Range, the Coast Ranges, and the Great Basin ranges. South America, Asia, and Europe also have great cordilleras. SIGISMOND DER. DIETTRICH

CORDITE, *KAWR dyt,* is one of the original smokeless powders used to propel projectiles from guns. The name *cordite* refers to the cordlike lengths in which it is made. Cordite is composed of 30 per cent nitroglycerin, 65 per cent nitrocellulose, and 5 per cent petrolatum. The British government adopted the original cordite formula in 1887. This cordite burned with so much heat it damaged gun barrels. JULIUS ROTH

CÓRDOBA, *KAWR duh buh* (pop. 798,663), in northern Argentina, is the country's third largest city. It is the capital of an Argentine province also called Córdoba. For location, see ARGENTINA (political map).

The city lies 1,240 feet (378 meters) above sea level, in an irrigated grazing area. Córdoba is a market center for livestock, wool, and hides. Founded in 1573, it is the oldest major city in Argentina. GEORGE I. BLANKSTEN

CÓRDOBA, *KAWR duh buh* (pop. 235,632), is an ancient Moorish city in Spain, and the capital of Córdoba province. It lies 86 miles (138 kilometers) northeast of Seville. For location, see SPAIN (color map).

Romans occupied Córdoba in 206 B.C. It reached its peak of importance in the A.D. 900's as a famous center of Moorish art and culture. A mosque is Córdoba's chief landmark. It was built as a Moslem house of worship in the 700's, and was made into a Roman Catholic cathedral in 1238. More than 1,000 pillars of granite, onyx, marble, and jasper support its arches.

Nearby farms produce cereals, grapes, olives, and vegetables. Córdoba is the home of soft, fine-grained cordovan leather. STANLEY G. PAYNE

CORDOBA is the unit of paper money in Nicaragua. One hundred centavos make one cordoba. It is named after the Spanish explorer, Francisco Fernández de Córdoba (1475?-1526). See MONEY (table: Values).

CÓRDOBA, FRANCISCO FERNÁNDEZ DE. See EXPLORATION AND DISCOVERY (table).

CORDOBÉS, EL (1936-), a Spanish bullfighter, became the highest-paid matador of all time. From 1964 through 1971, he averaged at least $1 million a year fighting bulls. El Cordobés had an awkward and unusual style, but experts considered him one of the most daring matadors in history.

El Cordobés' real name is Manuel Benítez. He was born in Palma del Río, near Córdoba. The nickname "El Cordobés" means "the man from Córdoba." He became a bullfighter in 1959 after working as a bricklayer and serving in the Spanish Army. In 1970, he broke his own record by appearing in 121 bullfights in one season in Spain. He retired in 1972. BARNABY CONRAD

CORDUROY, *KAWR duh roy,* is a cotton or rayon fabric with raised ribs of the cloth running lengthwise. The name probably comes from the French phrase *cord du roi,* meaning *king's cord.* Corduroy with wide ribs is called *wide-wale corduroy.* The type with narrow ribs is *pin-wale corduroy.* Corduroy is made 36 inches (91 centimeters) wide for use in clothing. Corduroy is made 50 inches (130 centimeters) wide for draperies and upholstery. It may be in one color or a variety of printed patterns. KENNETH R. FOX

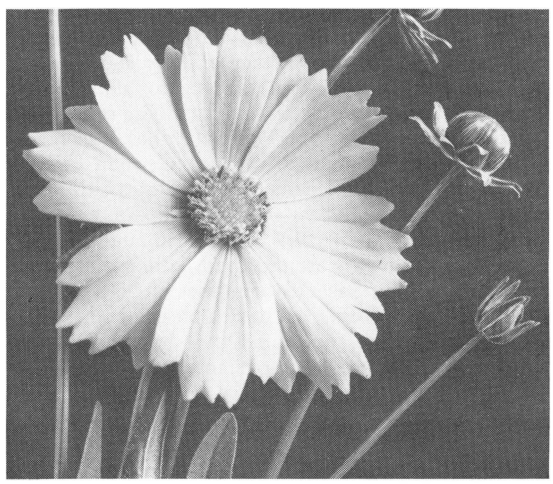
CORDUROY ROAD. See ROADS AND HIGHWAYS (Early American Roads).

CORE, in geology. See EARTH (Inside the Earth).

CORE. See CONGRESS OF RACIAL EQUALITY.

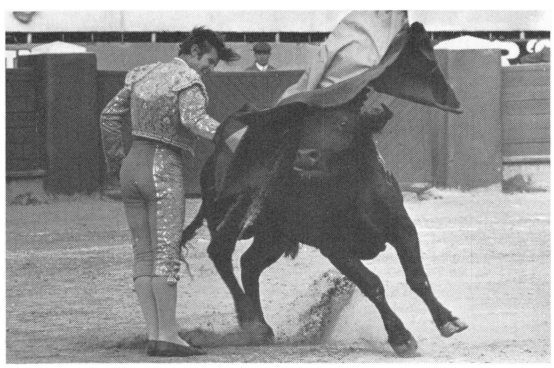
CORELLI, *koh REHL ee,* **ARCANGELO** (1653-1713), was an Italian composer. The violin at that time was replacing the viol. Corelli understood what the violin could do, and he wrote sonatas and concertos especially for string orchestra. His work laid the foundation for future developments in the use of string instruments. Corelli directed concerts at the Roman palace of Pietro Cardinal Ottoboni. PERCY M. YOUNG

COREOPSIS, *KAWR ee AHP sihs,* is a large group of plants related to the sunflower. They are commonly called *tickseed.* The plants may be from 1½ to 4 feet (46



J. Horace McFarland

Coreopsis Flowers Look Like Daisies and may have one or two layers of petals. The blooms are usually red or yellow.



Charles Marden Fitch, FPG

El Cordobés, one of the most daring matadors of all time, earned more money fighting bulls than any other man.

to 120 centimeters) high. Their yellow, red, or maroon flowers look like daisies and grow on slender stems. The leaves are often *lobed* (cut out). The flat fruits are small and dry and look like bugs. *Coreopsis* is the Greek word for *bug*. Most coreopsis plants are perennials and live for several years. But some are annuals and live only one season. The annual coreopsis is often called *calliopsis*.

Scientific Classification. Coreopsis plants belong to the composite family, *Compositae*. They form the genus *Coreopsis*. A common annual is *C. calliopsidea*. MARCUS MAXON

CORFU, *kawr FOO*, or in Greek, KÉRKIRA, is the northernmost of the Ionian Islands. The mountainous island covers 229 square miles (593 square kilometers), and has about 97,500 people. It lies off the western coast of Greece (see GREECE [color map]). It produces olives, citrus fruit, and wine. Corfu has also become an important tourist center. Colonized about 700 B.C. by the Corinthians, Corfu was one of the causes of the Peloponnesian War. The Ionian Islands were ceded to Greece by Great Britain in 1864. See also IONIAN ISLANDS. HARRY N. HOWARD

CORGI. See WELSH CORGI.

CORI is the name of two Czech scientists. Carl Ferdinand Cori (1896-) and Gerty Theresa Radnitz Cori (1896-1957), husband and wife, shared the 1947 Nobel prize for physiology and medicine. They showed how an enzyme converts animal starch into blood sugar. Their work made possible an understanding of diabetes mellitus. Both were born in Prague (Praha), Czechoslovakia, and were graduated from the German University there. The Coris became United States citizens in 1928. HERBERT S. RHINESMITH

CORIANDER, *KAWR ee AN duhr*, is an annual herb that grows in the countries around the Mediterranean Sea. The plant is about 3 feet (91 centimeters) high and has small white flowers. Its seeds have a pleasant odor when ripe, and they taste sweet after they have been dried out. The seeds are used as a spice in curries, sauces, and liqueurs, and to make small round candies. They are used in Europe more than in the United States or Canada. But the United States usually imports about 1,400,000 pounds (635,000 kilograms) of coriander seeds a year. Coriander-seed oil is used to flavor food, and as a medicine. About 500 pounds (230 kilograms) of seeds yield 5 pounds (2.3 kilograms) of oil.

Scientific Classification. Coriander belongs to the parsley family, *Umbelliferae*. It is genus *Coriandrum*, species *C. sativum*. HAROLD NORMAN MOLDENKE

CORINTH, *KAW rihnth*, was one of the most important cities of ancient Greece. It was founded in prehistoric times on the isthmus that connects the Peloponnesus with the rest of Europe (see GREECE, ANCIENT [color map]). According to Homer, it was the home of Bellerophon, Medea, and Sisyphus.

Corinth was favorably situated for trade by land. It also had good harbors at Cenchreae and Lechaeum, on either side of the isthmus. By 750 B.C., Corinth had become the wealthiest city of ancient Greece. Except for two periods (454-404 B.C. and 146-44 B.C.), it maintained economic supremacy for about 1,300 years.

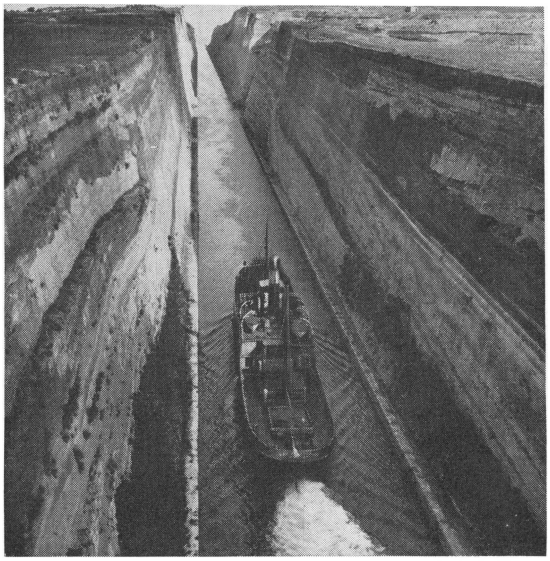
In 734 B.C., Corinthians founded colonies at Corcyra (now Corfu), an Ionian island west of Greece, and at Syracuse in Sicily. In 581 B.C., they instituted the Isthmian Games, an international festival held every second year (see ISTHMIAN GAMES). The games honored their principal god, Poseidon. Corinth was famous for its skilled workers in bronze and clay, and for its naval architects. Because of commercial rivalry with Athens, Corinth was the chief instigator of the Peloponnesian War (see PELOPONNESIAN WAR).

The Romans destroyed the city in 146 B.C., but later rebuilt it by order of Julius Caesar. Emperor Augustus made it capital of the Roman province of Achaea. Saint Paul visited Corinth in A.D. 51 and founded a church there (see CORINTHIANS, EPISTLES TO THE).

In the Middle Ages, the city was largely confined to its citadel, Acrocorinth. American archaeologists began excavations in Corinth in 1896. DONALD W. BRADEEN

Ewing Galloway

Relic of Ancient Corinth, these Doric columns were once part of the Temple of Apollo. Each column is a single stone 23½ feet (7.2 meters) high and over 17 feet (5.2 meters) around at the base. The Apostle Paul, on one of his visits to Greece, saw people worship heathen gods in this temple.



Ewing Galloway

Corinth Canal links the Gulf of Corinth with the Saronic Gulf. It is about 4 miles (6 kilometers) long, 81 feet (25 meters) wide, and 23 feet (7 meters) deep.

CORINTH CANAL flows between the lower part of Greece and the northern mainland. It provides a waterway between the Gulf of Corinth and the Saronic Gulf. The town of Isthmía lies at the eastern end of the canal, which is 4 miles (6 kilometers) long, and Posidhonía is at the western end.

A French company began building the canal in 1882, and Greece finished it in 1893. An attempt to build such a canal had been made by the Roman Emperor Nero in A.D. 67. C. BRADFORD WELLES

CORINTHIAN COLUMN. See COLUMN.

CORINTHIANS, *kuh RIHN thee uhnz*, **EPISTLES TO THE,** the seventh and eighth books of the New Testament, were written by the Apostle Paul probably about A.D. 54.

The first *epistle* (letter) was sent from Ephesus, in present-day Turkey, to a Christian church which Paul had organized in Corinth, Greece. The epistle was written after word came to Paul that the church was split into four divisions, each claiming a different leader. It included suggestions for solving this and other problems. A famous passage is Chapter 13, which deals with Christian love.

Paul wrote the second epistle in two parts. Chapters 10 to 13 include a severe letter which Paul wrote after the first epistle failed to unite the Corinthian church. Even his authority and sincerity had been challenged. Chapters one to nine are a later letter written from Macedonia expressing gratitude that friendliness had been re-established. WILLIAM WILSON SLOAN

See also PAUL, SAINT.

CORINTO, *koh REEN toh* (pop. 9,177), the main Pacific Ocean port of Nicaragua, is the western terminus of the government railroad. About 85 per cent of the republic's agricultural exports pass through the city. These include coffee, sugar, animal hides, and lumber. Corinto is on an island that is connected to the mainland by a bridge. For the location of Corinto, see NICARAGUA (color map). ROLLIN S. ATWOOD

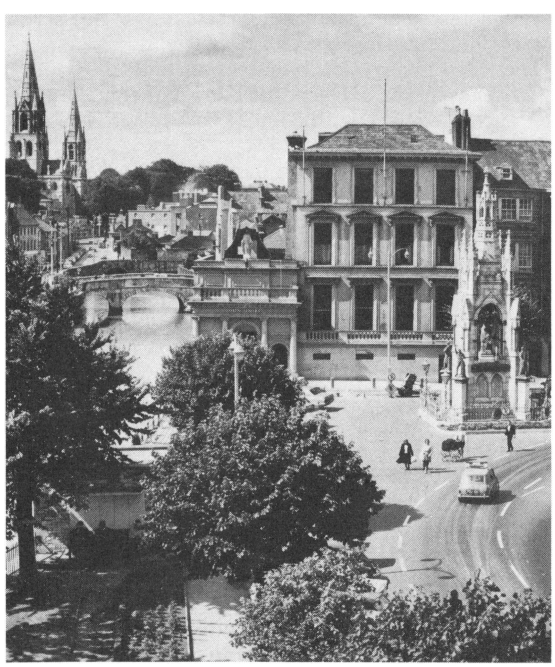
CORIOLANUS, *KAWR ee uh LAY nuhs*, **GAIUS MARCIUS,** was a general of the early Roman Republic. He was given his last name as a reward for his skill and bravery in capturing the town of Corioli from the Volscians, bitter enemies of Rome.

During a famine in 491 B.C., Coriolanus suggested that no grain be given to the poor unless they gave up their right to elect *tribunes* (representatives). The people became indignant over this, and exiled Coriolanus. He joined the Volscians to get revenge, and led their army to the gates of Rome. He was about to capture the city when his mother and wife persuaded him to spare Rome. The angry Volscians then killed Coriolanus. William Shakespeare told the story of this warrior in his tragedy of *Coriolanus*. HERBERT M. HOWE

CORIOLIS FORCE, *KAWR ee OH lihs*. An object moving over the earth or any other rotating body tends to move in a straight line. But the earth rotates beneath the moving object. To someone rotating along with the earth, the path of the object appears to curve, as if it were pushed. Objects tend to drift to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. This push is called the *Coriolis force*, or the *Coriolis effect*. It was named after the French mathematician Gaspard G. Coriolis, who first analyzed it. The Coriolis force mainly affects objects moving above the earth that are not affected by the forces of friction. Such objects as airplanes, rockets, bullets, and air masses have curved paths. The Coriolis force is important to the weather and the direction of the wind. See also AIR (Air Movement); WEATHER (Air Movement).

CORIUM. See SKIN.

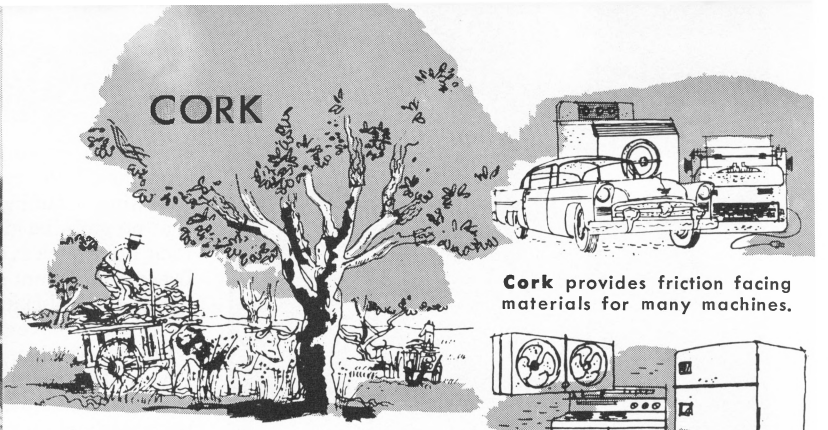
CORK, *kawrk* (pop. 128,645; met. area 134,430), is the second largest city in the Republic of Ireland. The main part of Cork is on an island between two arms of the Lee River. The rest of the city spreads over hill-



Irish Tourist Board

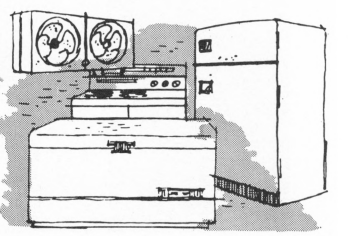
Cork, Ireland, lies on two branches of the Lee River. The city began as a Viking settlement during the A.D. 800's.

Armstrong Cork Co.

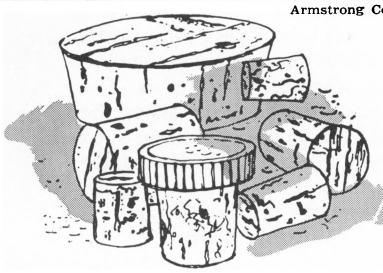


Cork Harvest Workers chop two horizontal and two vertical cuts in the outer bark of the cork oak, *left*. Then they strip the cork from the tree with wedge-shaped hatchet handles and dry the strips of cork in the sun, *above*.

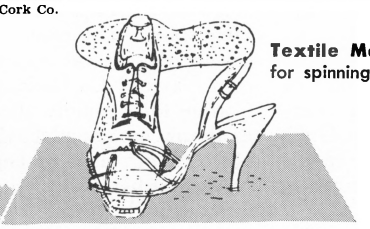
Cork provides friction facing materials for many machines.



Cork Gaskets are used in refrigerators and other household appliances.

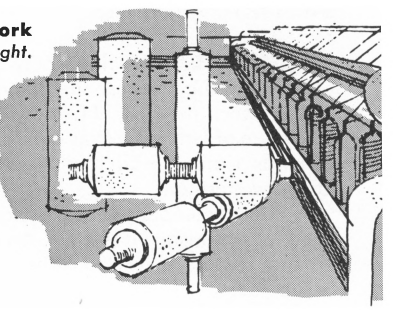


Bottle or Jar Stoppers are familiar cork articles.



Textile Makers Use Cork for spinning-roll covers, *right*.

The Shoes We Wear and some kinds of tile flooring often contain cork.



sides along the river. For location, see IRELAND (map).

Cork has large iron foundries, shipbuilding yards, an automobile plant, and factories that produce fertilizers, flour, leather, paper, and woolen and linen goods. The city's many fine buildings include the Roman Catholic Church of Christ the King and Saint Finbar's Church of Ireland Cathedral. The University College is located in Cork.

Saint Finbar, an Irish bishop, founded a church at Cork in the 600's. Viking raiders began the first permanent settlement in the 800's. The city's 4 miles (6 kilometers) of *quays*, or artificial riverbanks, and its beautiful, broad streets, including Patrick Street, Grand Parade, and South Mall, were built in the 1700's. When Great Britain granted Ireland home rule in 1921, Ireland gave the British permission to use Cork Harbor as a naval base. The British withdrew their forces from Cork in 1938.

T. W. FREEMAN

CORK is a lightweight, spongy substance obtained from the bark of the cork oak tree. It does not absorb water readily and can be compressed a great deal, but springs back when released. Men used cork as early as 400 B.C. The Romans wore cork sandals and used cork to float anchors and fishing nets. Cork bottle stoppers have been made since the 1600's.

The Tree. The cork tree is a live oak. This means that it is green the year round. It grows abundantly in Portugal and Spain, where most of the world's cork is produced. Algeria is the third most important country in cork production. The cork oak has been planted in parts of California, and in some of the southeastern states, but the total yield of cork there is small. The outer layer of the bark is composed of dead cells whose thin walls have become thickened and waxy. These cells are so compact that each may be in contact with 14 others. The cork tree lives from 300 to 400 years, but seldom grows more than 50 feet (15 meters) high.

Gathering Cork. A cork tree must be approximately 20 years old before its bark is thick enough to be stripped. The first layer removed is called the *virgin bark*. Workers strip the bark during June, July, and August. Each tree can be stripped about once every 10 years. The best cork comes after the second stripping.

A cork stripper uses a long-handled hatchet to cut long, oblong sections of bark from the top of the lowest branches to the bottom of the tree. The sections of bark are pried off carefully with the wedge-shaped handle of the hatchet. The inner layer continues to produce more cork after each stripping. Cork will never grow again on a spot where the inner layer of bark has been bruised by the stripper's hatchet.

Preparation for Market. The slabs of stripped cork are boiled, and a rough, gritty outer layer is scraped off. The boiling dissolves tannic acid from cork, and softens the material so that the slabs can be straightened out and packed in bundles. Before being loaded on ships, cork is sorted according to quality and thickness.

Uses. Most cork is used for insulation. For this purpose, it is ground and pressed into boards and pipe coverings. In this form, cork covers the walls and freezing pipes of thousands of cold-storage plants, meat-packing factories, ice-cream plants, and oil refineries.

Cork floats in water, and is used in making buoys and floats for fishing nets. Linoleum is made by mixing cork powder with linseed oil and spreading this paste over canvas or burlap. Floors are made soundproof with cork. One of its principal uses is for "corks," or bottle stoppers. Thin cork gaskets seal metal bottle caps. Cork is also used in waterproof coatings, in balloon fabric, as filling for automobile tires, and as wadding for shotgun cartridges. Cork shavings are burned to make *Spanish black*, or *cork black*, a paint used by artists.

Scientific Classification. The cork oak tree belongs to the beech family, *Fagaceae*. It is genus *Quercus*, species *suber*. HARRY E. TROXELL

See also INSULATION; OAK; PORTUGAL (Cork; picture: Cork from the Oak Forests).

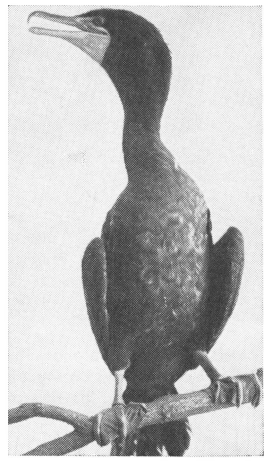
CORLISS, GEORGE HENRY (1817-1888), an American engineer, helped perfect the steam engine. His refinements included a more reliable governor that cut off steam from the engine according to the load put upon it. Corliss also designed the largest engine built up to that time. He designed it for the Philadelphia Exposition of 1876.

Corliss was born in Easton, N.Y. He first worked as an engineer with an engine firm in Providence, R.I. He later headed his own company. RICHARD D. HUMPHREY

CORM is a short, thick, underground stem from which other plants can be grown. It resembles a bulb. But most of the corm consists of stem tissue. A corm has smaller and thinner leaves than a bulb. Unlike the bulb, the corm stores food in the stem, instead of in the thickened leaves. Small corms are called *cormels*. See also BULB; STEM.

CORMORANT, *KAWR moh runt*, is a large, web-footed bird that catches fish by diving under water. Different kinds of cormorants are found throughout the world. Most of them live on seacoasts, but they are often seen on large rivers and lakes. The cormorant is related to the pelican. The large kinds are more than 30 inches (76 centimeters) long. All have long, powerful bills with a hook on the end. The cormorant has powerful wings. Its tail feathers spread out like a partly opened fan.

One of the most common cormorants of North America, the *double-crested cormorant*, perches in trees, on rocks, and on the ledges of sea cliffs. Hundreds of these birds live around the Bay of Fundy in Nova Scotia and New Brunswick. With their feathered bodies, long necks, and flat heads, they look like rows of bottles sitting on the cliffs. The double-crested cormorant has greenish-black, bronze-tinted feathers. During the nesting season it has a crest of white curved feathers behind each eye. It has an orange throat. The *common cormorant* is larger and has white feathers bordering the throat.



N.Y. Zool. Soc.

The Cormorant is related to the large-beaked pelican.

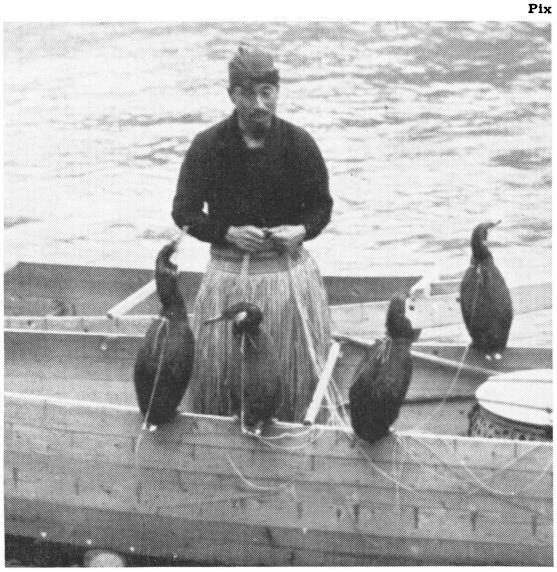
Cormorants can stay under water a long time when they dive for fish. They swim with their webbed feet. These birds fly close to the water looking for fish, or they perch on a branch over the water and wait for fish to appear. The birds dive into the water to catch the fish.

Scientific Classification. Cormorants belong to the cormorant family, *Phalacrocoracidae*. The common cormorant is genus *Phalacrocorax*, species *P. carbo*. The double-crested cormorant is *P. auritus*. ALEXANDER WETMORE

See also BIRD (Bird Pets); PELICAN.

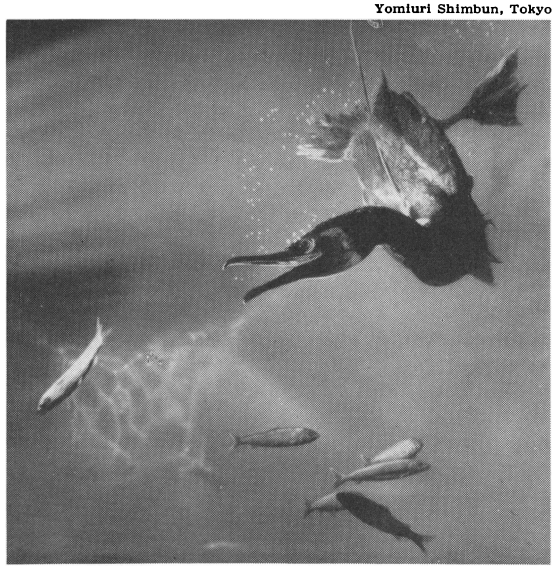
Fishermen in the Orient Have Long Used Cormorants to catch fish. They tie long cords to the birds to keep them from flying away with the fresh fish they catch.

Pix



The Cormorant dives into the water to catch fish for its owner with its long hooked bill. A metal ring around its neck prevents the bird from swallowing the fish.

Yomiuri Shimbun, Tokyo



Grant Heilman

Grant Heilman

Rows of Corn cover more land in the United States than any other crop. By late July, tassels bearing pollen have formed on top of the cornstalks, *left*. The pollen fertilizes egg cells on the young cobs. By mid-September, the ripe corn, *right*, is ready to be harvested.

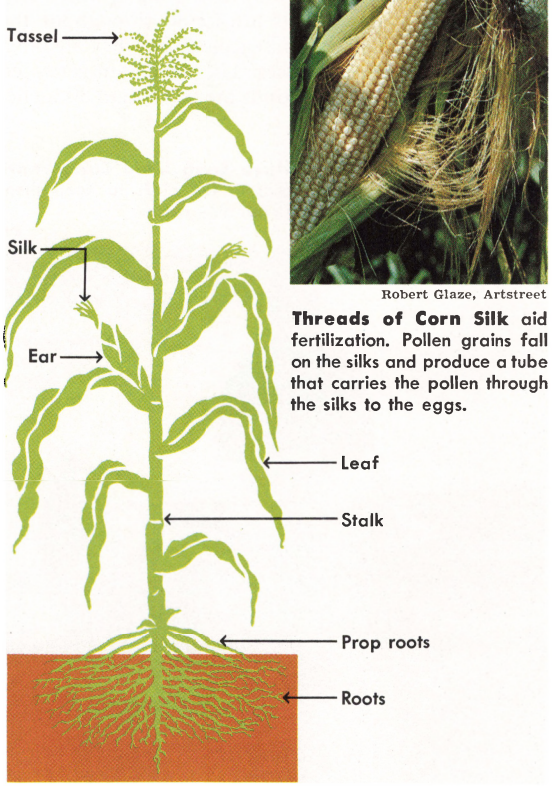
CORN is the most valuable crop grown in the United States. Along with wheat, rice, and potatoes, it ranks as one of the four most important crops in the world. When Christopher Columbus landed in Cuba in 1492, he sent two of his men to explore the island. When they returned, they told him about "a sort of grain called maiz." This was the first time white men had heard of the plant that we call corn. In the British Isles, people call corn *maize* (Indian corn). They use the word *corn* for such grains as wheat, oats, barley, and rye.

Corn is a favorite food throughout North and South America. People enjoy juicy ears of corn on the cob, flavored with butter and salt. Corn flakes, corn-meal mush, and hominy grits are popular breakfast foods. Millions of people munch hot buttered popcorn at parties and at motion-picture theaters. Latin Americans eat many foods made from corn, including tamales and tortillas.

In the Corn Belt of the Middle West, cornfields often stretch as far as the eye can see. Corn grows in almost every state. But four-fifths of the corn produced in the United States grows in the Corn Belt. This area includes Illinois, Indiana, Iowa, Minnesota, Missouri, Nebraska, Ohio, and South Dakota. Leaders in United States corn production include Iowa, Illinois, Nebraska, and Indiana. Many farmers in the Corn Belt have "corn-hog farms." These farmers feed most of their corn to hogs.

Corn covers about 72 million acres (29 million hectares) of land in the United States, more than any other crop. Every year the nation's farmers harvest about $6 billion worth of corn. The United States usually produces about 50 per cent of the world total. Other large corn producers include Brazil, China, France, Romania, Russia, and South Africa. Canada grows corn

PARTS OF THE CORN PLANT



Robert Glaze, Artstreet

Threads of Corn Silk aid fertilization. Pollen grains fall on the silks and produce a tube that carries the pollen through the silks to the eggs.

chiefly in the provinces of Ontario, Quebec, and Manitoba.

Farmers in the United States feed the largest part of the corn crop to their livestock. They sell the rest of the crop to industries for use in processed food and industrial products, including corn syrup, cornstarch, and plastics.

Uses of Corn

Livestock Feed. Farmers feed about four-fifths of the corn grown each year to hogs, cattle, sheep, and poultry. Hogs eat almost half the corn crop. Corn provides the base for many kinds of poultry feeds and dairy feeds. Every year, about 85 million short tons (77 million metric tons) of corn and cornstalks are made into *silage*, a fermented livestock feed (see SILO).

Corn production is closely related to hog and cattle raising, because these animals depend chiefly on corn for food. The Corn Belt states usually raise more than half the hogs in the United States, and nearly half the cattle. The price that farmers can receive for their corn helps them decide what to do with it. As corn prices rise, for example, farmers usually sell more corn and raise fewer hogs. They receive more money by selling the corn than they would by feeding it to the hogs and then selling the hogs. If corn prices fall, farmers generally raise more hogs and feed the corn to them, because the hogs would bring in more money than the corn.

Food for Man. Americans eat an average of about 45 pounds (20 kilograms) of corn per person every year. Many kinds of food are made from the kernels. Corn also provides food indirectly. We eat it in the form of

LEADING CORN-GROWING STATES

Bushels of corn grown in 1973*

Iowa	1,204,200,000 bu.
Illinois	996,010,000 bu.
Nebraska	544,050,000 bu.
Indiana	534,480,000 bu.
Minnesota	513,360,000 bu.
Ohio	240,160,000 bu.
Missouri	228,800,000 bu.
Wisconsin	173,470,000 bu.
Kansas	154,000,000 bu.
South Dakota	142,020,000 bu.

Includes corn used for grain, but not for silage, hogging down, grazing, or forage.
*One bushel equals 56 pounds (25 kilograms).

Source: *Crop Production 1973 Annual Summary*, U.S. Department of Agriculture.

LEADING CORN-GROWING COUNTRIES

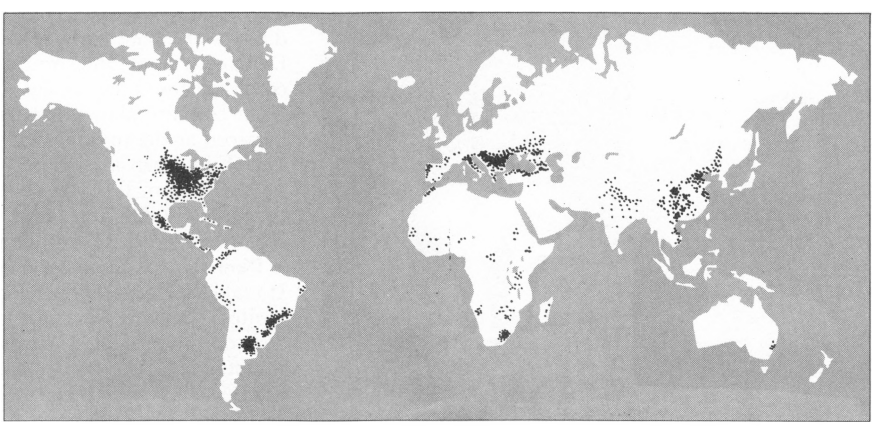
Bushels of corn grown in 1973*

United States	5,643,300,000 bu.
China	984,200,000 bu.
Brazil	598,400,000 bu.
Russia	529,100,000 bu.
South Africa	433,100,000 bu.
France	420,100,000 bu.
Romania	378,900,000 bu.
Argentina	377,900,000 bu.
Mexico	362,200,000 bu.
Yugoslavia	325,000,000 bu.

Includes corn used for grain, but not for silage, hogging down, grazing, or forage.
*One bushel equals 56 pounds (25 kilograms).

Source: *World Agricultural Production and Trade*, March, 1974, U.S. Department of Agriculture.

LEADING CORN-PRODUCING AREAS OF THE WORLD



WORLD BOOK map

meat and meat products that come from animals raised on corn. Corn, in one form or another, makes up more of our diet than any other farm crop.

We eat corn just as it comes from the ear in succotash, chowder, pudding, popcorn, fritters, parched corn, and as roasted or boiled corn on the cob. We sometimes eat soft, white hominy, made by treating the whole grains with lye and washing them carefully. Manufacturers flavor hominy, roll it out, and toast it to make corn flakes. Corn kernels are coarsely ground to make corn meal. Foods made from corn meal include corn bread, cookies, tamales, and waffles. Corn kernels are high in food value. They provide a rich source of fats, proteins, and carbohydrates. One pound or 0.5 kilogram (about 3 ears) of sweet corn, boiled on the cob, contains about 550 calories.

Corn refining is the process of separating the kernel into its parts. The basic products of refining are starch, sugar, syrup, and oil. *Corn oil* is used as a salad oil and cooking oil, and in other food products such as margarine and shortening. *Cornstarch* is used to thicken puddings, gravies, and sauces. It is also used in such products as candy, chewing gum, and baked goods. *Corn syrup*, made by heating cornstarch in closed tanks, sweetens many foods and is used as a spread for bread.

Other Products. Factories manufacture hundreds of important corn products that we do not eat. Manufacturers make wallboards and certain kinds of paper from cornstalks. Ground cobs can be substituted for cork. Corncobs are sometimes burned as fuel. Corncob meal may be used for fertilizer, for cleaning furs, and for polishing metal. Cobs are an ingredient of *furfural*, a chemical used in making plastic, nylon, and other industrial products (see FURFURAL). Smokers sometimes enjoy pipes made from corncobs.

Industries use corn meal in making adhesives, cork products, felts, cleaning compounds, plywood, and many other products besides foods. Starch, refined from corn meal, is used to stiffen and finish paper, yarns, and fabrics. Starch also plays a part in the manufacture of cosmetics, explosives, electric batteries, and drugs.

Corn sugar has uses in leather tanning, rayon and paper manufacturing, and other industries. Manufacturers make ethyl alcohol from corn sugar or syrup. Ethyl alcohol is an important ingredient in smokeless powder, shatterproof glass, synthetic rubber, brake fluids, and plastics (see ALCOHOL).

Doctors sometimes use injections of *dextrose*, or refined corn sugar, for patients who have had major operations or suffer severe injuries (see DEXTROSE). Corn sugar supplies a quick source of energy for the human body. Dextrose may also be an ingredient of certain drugs. Druggists sometimes use cornstarch in pills and tablets. Corn syrup sweetens cough syrup and other liquid medicines. Manufacturers use corn oil in soaps, glycerine, paints, varnishes, and rubber substitutes.

CORN PRODUCTS

Food for Man

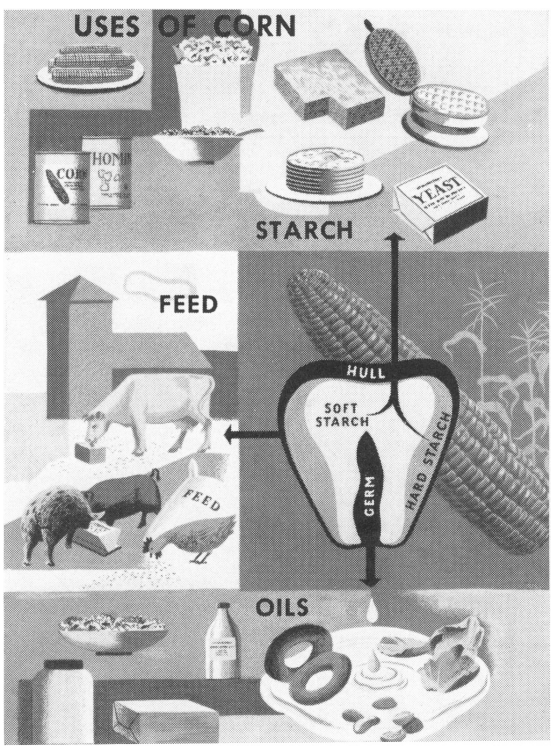
Baked goods	Ice cream	Sausage
Baking powder	Icings and candy	Shortening
Breakfast foods	Jams and jellies	Syrup
Catsup	Margarine	Tamales
Chewing gum	Popcorn	Vinegar
Cooking oil	Puddings	Yeast
Corn flour	Salad dressing	

Food for Livestock

Corn bran	Fodder	Gluten meal
Corn grain	Germ cake and meal	Oil cake and meal
Corn meal	Gluten feed	Silage

Other Products

Adhesives	Fertilizer	Photographic film
Antifreeze	Fuel	Plastics
Antiseptics	Furfural	Safety glass
Ceramics	Insulating materials	Soaps
Cork substitute	Paints	Solvents
Dyes	Paper and paperboard	Synthetic fibers
Ether	Pastes	Varnishes
Explosives		Whisky
Felt		



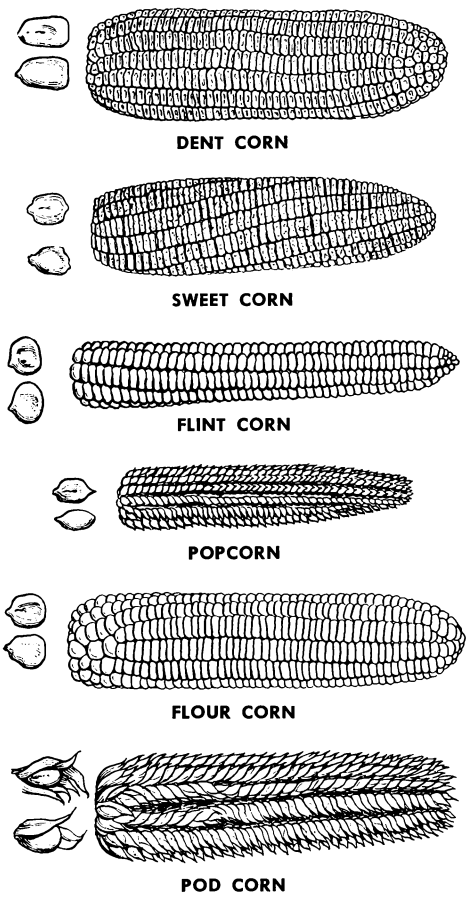
Kinds of Corn

The six main kinds of corn have different types of kernels. These kinds are: (1) dent corn, (2) sweet corn, (3) flint corn, (4) popcorn, (5) flour corn, and (6) pod corn. The term "Indian corn" may be used to mean any of these kinds of corn. But the corn that the Indians taught the early settlers to grow was flint corn. Dent corn and flint corn are commonly called "field corn" because they are fed to animals. Broomcorn and Kafir corn are plants that resemble corn. But they are not corn as the term is used in the United States.

Hybrid corn is produced by crossing two types of purebred corn. Breeders can produce hybrids of any of the different kinds of corn. Most breeding of hybrid corn has been done with dent corn.

Dent Corn is the most common commercial variety. It makes up about 90 per cent of the corn grown in the United States. Each kernel of dent corn has a small dent on the top. This dent is made when the hard and soft starch in the kernel shrink unequally as it dries. Farmers harvest dent corn when the seeds become hard and ripe. Most dent corn is hybrid corn.

THE SIX MAIN KINDS OF CORN



Dent corn may be used as a livestock feed on the farm where it grows. Or it may be sold to manufacturers, who can make many food and industrial products from it. Dent corn is grown in all parts of the Corn Belt.

Sweet Corn is grown chiefly for people to eat. Farmers must pick it at just the right time to ensure the best flavor. Sweet corn tastes best when picked while a milky fluid fills the kernels. It is not as good after the kernels have begun to harden and the corn is getting ripe.

Unless it is kept refrigerated, sweet corn quickly loses its flavor after harvesting. This happens because heat turns the sugar in the kernels to starch. Refrigerated trucks and railroad cars make it possible to carry fresh sweet corn far from the places where it grows. Canned and quick-frozen sweet corn last indefinitely, and can be shipped throughout the world. Most sweet corn grows in the northern states. Wisconsin, Minnesota, and Illinois lead in sweet corn production. The center of the corn-canning industry is just north of the Corn Belt. Minnesota, Wisconsin, northern Illinois, and Maine lead in the canning of sweet corn.

Sweet corn is a good source of energy. It contains twice as much sugar as dent corn. It is also a good source of vitamins A and C. Sweet corn may have white or yellow kernels. It has smaller stalks and ears than dent corn.

Flint Corn has hard kernels with a smooth coat. They vary in color from white through golden yellow to deep red. The ears sometimes appear on the stalk close to the ground. Flint corn can grow in cold climates because it ripens in less time than other kinds of corn. Wisconsin, the New England States, and other northern states grow flint corn. Argentina, a leading world producer of corn, grows almost no other type of corn but flint. Argentina exports much of its corn. Flint corn can be shipped and stored with less spoilage than other kinds.

Popcorn is one of the favorite "fun foods" of Americans. People eat it plain with salt and butter, or cover it with caramel or white sugar sirup. Popcorn has small, hard kernels that are either rice-shaped with pointed ends or flat with rounded ends. A tough outer coat covers each kernel. When the kernels are heated rapidly, the moisture inside them turns to steam. This steam builds up a great pressure within the kernel. This pressure bursts the kernel's outer shell, and the entire inside of the kernel puffs out. Other kinds of corn crack and parch when heated, but do not pop. Indiana, Iowa, Illinois, and Ohio lead in growing popcorn. See POPCORN.

Flour Corn, or soft corn, is one of the oldest types of corn. It has soft, starchy kernels. The Indians in the southwestern United States mainly grow flour corn. They can grind the kernels by hand because flour corn has softer kernels than other kinds of corn. Flour corn ripens late in the season. It grows in the warm areas of South America, but is not grown commercially in the United States.

Pod Corn has a separate covering around each kernel. In all other corns, the kernel has no separate covering. Some scientists believe pod corn may be the ancestor of all other types of corn. Pod corn has never been grown commercially, because the husks on each kernel make it hard to use.

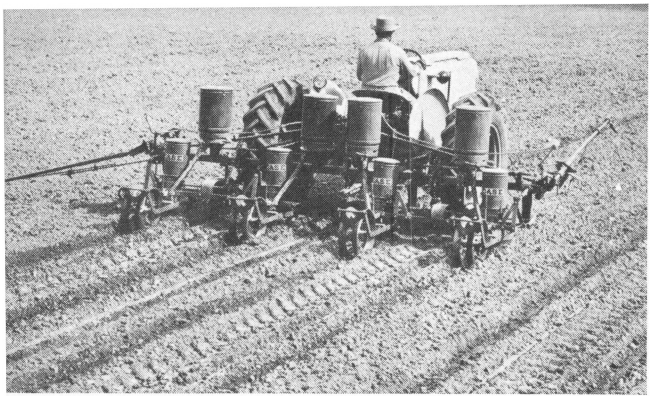
The Corn Plant

Corn is really a grass, but an unusual one. It belongs to the group of six true grains, or cereals, that includes wheat, barley, oats, rice, and rye. The corn plant usually grows 3 to 10 feet (0.9 to 3 meters) tall and has many short *ear shoots*, or branches. But the giant corn of the Jala Valley in Mexico has ears 3 feet (0.9 meter) long. Its strong stalks can be used to make fences.

Stalk. The tough, jointed *cornstalk*, or stem, resembles bamboo. It has a central core of *pith* (soft, spongy tissue). A root system with many branches supports the green stalk. Sometimes *prop roots* grow out of the stalk above the ground to help support the plant against the wind. The *tassel* grows at the top of the cornstalk. It contains hundreds of small flowers that produce pollen. Most corn flowers are pink, but they may be green, yellow, red, or purple.

Leaves. At each joint of the stem, a long, swordlike leaf curves gracefully outward and downward, ending in a pointed tip. The lower part of the leaf partly encloses the stem, forming a *sheath*. The *blade* (upper part of the leaf) is long, narrow, and pointed.

Ears of corn grow from the places where the leaves join the stalk. A corn plant may have one ear, or as many as eight. *Husks* (a special kind of leaf) enclose and



Planting Corn on this Indiana farm is done with a tractor-drawn machine that plants four rows of seed at a time.

J. I. Case

Cultivating a Cornfield controls weeds and loosens the soil. Corn needs cultivation only when it is young.

protect each ear. An ear consists of a *corncob* covered with rows of *kernels*, the seeds of the corn plant. An even number of rows usually grow on the ear. An ear may have 8, 10, 12, or more rows of kernels. Each kernel has what looks like a silk thread that runs from the kernel up the row, and sticks out of the husk at the end of the ear. This thread is called the corn *silk*.

Every kernel has three parts: (1) the *hull*, or outer covering; (2) the *germ*, or young embryo corn plant; and (3) the *endosperm*, which makes up the rest of the kernel. When the kernel is planted, the young plant uses the endosperm as food as it begins to grow. The endosperm is made of *hard starch* and *soft starch*. Different kinds of corn have different amounts of these two kinds of starch in their kernels. See CORNSTARCH.

Natural Pollination. In midsummer, the wind shakes pollen out of the tassels and blows it about like dust. Some of the pollen grains fall on the sticky threads of corn silk hanging out of the young ears.

When a pollen grain lands on the silk, it sends out a tiny pollen tube that grows down the silk to an egg cell in the young kernel. There, a male cell from the pollen grain *fertilizes*, or unites with, the egg cell. As the fertilized egg cell grows, the whole kernel becomes the seed. Corn cannot reproduce successfully for more than a few years without man's help. If corn grows wild, the heavy seeds all fall too close to the parent plant.

Hand Pollination, or **Hand Breeding,** is the transfer of pollen by hand from the tassel to the silk. Breeders cover the tassels of certain corn plants with paper bags before the tassels are ready to shed their pollen. They place bags over the young ears of other corn plants before the silk is ready to receive pollen. They *detassel*, or remove the tassels from these plants. The tassels and ears continue to grow in the bags. When the silk is ready, breeders carefully dust the pollen from the tassel onto the silk of the ear. They protect the pollinated ear with a bag so that no more pollen can reach it. After the kernels ripen, they are labeled and stored for use as seeds.

By using hand breeding, instead of allowing the wind to pollinate the plants, breeders can control the reproduction of corn. They also can *cross-fertilize* one plant with another to obtain the best qualities of each.

Hybrid Corn

More than nine tenths of the corn grown in the United States is hybrid. Its use is rapidly increasing in other important corn-growing areas of the world. Hybrid corn plants produce up to one third more corn than do the best varieties developed by other methods of breeding. Hybrids are also bred to have a greater ability to withstand drought, diseases, and pests. All the ears of hybrid corn ripen at the same time. Hybrids have stronger stalks and roots than other types of corn. The plants are more uniform and stand up better, and the ears can be more easily harvested with mechanical equipment. No hybrid has all these desirable qualities, but each type has some of them.

To produce hybrid corn, breeders first produce *pure strains*, or plants that have the same characteristics year after year. They do this by *inbreeding*, or fertilizing a plant with pollen from the same plant. Breeders take pollen from the tassel of a corn plant and place it on the silk of an ear of the same plant. Plants grown from seeds produced by inbreeding are called *inbreds*. After inbreeding for several years, inbred plants tend to be the same year after year. For example, the seeds of small plants produce only small plants. These plants are pure strains. But most inbreds do not grow as well as cross-fertilized plants. Some are weak, and others grow only one small ear. Because of their small yields, inbreds are used only for breeding. However, by cross-fertilizing plants from two different inbred lines, breeders can produce plants that are better than either parent.

The main kinds of hybrid corn seed are *single-cross* seed, which is produced by crossing two inbred lines, and *double-cross* seed, which results from crossing two single crosses. Double-cross hybrid seed can be produced more cheaply than single-cross hybrid seed, because it yields more seed for the land and labor used. Corn from a crop of hybrid corn cannot be used for seed, because it produces a crop with a lower yield. New hybrid corn seed must be produced and used every year. Since the 1930's, the production of hybrid seed has become an important commercial industry in the Corn Belt. In the 1950's, breeders found a way to prevent some of the parent plants from producing pollen. This eliminates the need for detasseling.

Growing Corn

Farmers plant field corn in the early spring, about 10 days after the average date of the final killing frost. The plants grow rapidly during the warm summer. They may grow as much as 3 to 5 inches (8 to 13 centimeters) a day during the three-week period before the tassels shed their pollen. In the Corn Belt, corn plants grow "knee-high by the Fourth of July," and head-high three weeks later. Growers harvest corn in the late

Harvesting Corn is an easy job with a mechanical picker that picks the ears, removes the husks, and drops the ears in a wagon.

J. I. Case; USDA

Farmers Store Corn in *cribs*. Temporary cribs, such as these, have no roofs. But for long storage, a roof is needed.

summer or early fall, depending on the climate and the breed of corn.

Corn plants grow best in a climate that provides rain during the growing season and warm weather for a month or so after pollination. The Corn Belt of the United States supplies all these conditions. Here, a large area of fertile land receives 8 to 10 inches (20 to 25 centimeters) of rain during the four months after corn planting. After the tassels appear, Corn Belt temperatures usually range from 70° to 80° F. (21° to 27° C) for 30 days or more. The area's level or gently rolling land allows farmers to use laborsaving machinery in the cornfields.

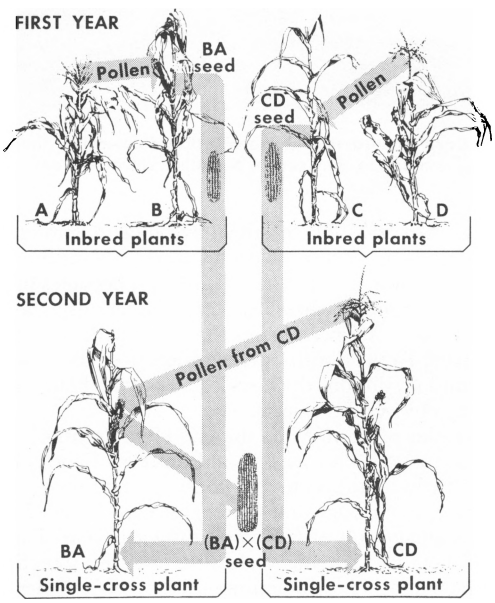
Planting. Corn plants need rich, well-drained soil. Farmers can improve poor soils with manure or artificial fertilizers. Sometimes, corn growers plant crops of legumes or grasses, called *green manures*, and plow them under to enrich the soil. Or they may grow corn in rotation with oats, clover, alfalfa, and other crops. The clover and alfalfa, like other legumes, enrich the soil for plants that follow them. See CROPPING SYSTEM.

Farmers plant corn in different ways. The most common methods are hill checking, power checking, drilling, listing, and bedding. In *hill-check* plantings, two to four seeds are dropped into hills spaced 3 to 4 feet (91 to 120 centimeters) apart. This type of planting lets the farmer cultivate all around the hills. In *power-check* planting, two or more seeds are dropped into hills arranged in rows. The farmer can adjust the distance between the hills in each row to any spacing he desires. In *drilled* plantings, the kernels are dropped individually with any desired spacing. Farmers in drier areas use *listing*, or lister planting. A machine called a *lister* opens a furrow and drops the seed into it. *Bedding* resembles listing except that the seeds are planted on the ridges instead of in the furrows. Some Southern farmers use bed planting on soils that are poorly drained at planting time. Power-checked, drilled, listed, and bedded corn can be cultivated only between the rows. The number of corn plants should range from 6,000 to 24,000 per acre (15,000 to 60,000 per hectare), depending on soil fertility, water supply, and other conditions.

Cultivation. Farmers cultivate their cornfields mainly to control weeds. They usually cultivate their fields twice, while the corn plants are small. After the corn has grown 25 to 30 inches (64 to 76 centimeters) high, it can compete successfully with the weeds for food and sunlight. Then, it does not need further cultivation. Chemical weed killers help to control weeds (see WEED [Weed Control]).

Harvesting Corn. Most farmers harvest their corn with machines. Mechanical *pickers* have almost replaced the older method of *husking* (removing the husks) by hand. Some growers use machines called *picker shellers* that pick and shell the corn in one operation. Sometimes, farmers turn their livestock loose in the fields to eat the ripened corn and fatten for market. When hogs harvest corn in this way, the process is called *hogging off*. Unless the farmer limits the range of his animals, this method of harvesting can be wasteful. In some parts of the country, farmers cut and *shock* (stack) the corn plants. They feed the shocked corn to livestock during the winter. Farmers sometimes cut down the cornstalks when the stalks are green and the ears are hard. Then, they chop the material and place it in silos to produce silage.

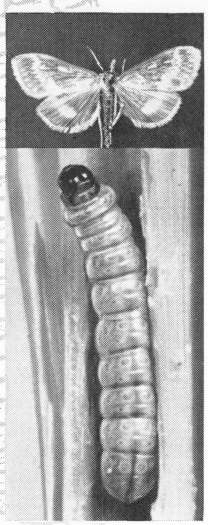
Ears of field corn are usually stored in ventilated bins

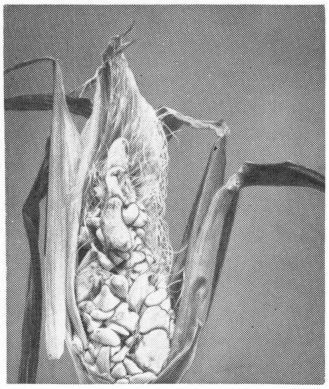


USDA

Hybrid Seed Corn is produced by double crossing. The four inbred strains are not good producers. Fertilizing plant B with pollen from plant A and plant C with pollen from plant D results in single-cross *hybrid* seed, BA and CD. The plants grown from this seed are better producers than the inbred plants. Still better results can be obtained from a second cross. Fertilizing plant BA with pollen from plant CD results in the *double-cross* seed corn, (BA) × (CD). This seed is sold to farmers for planting.

ENEMIES OF CORN

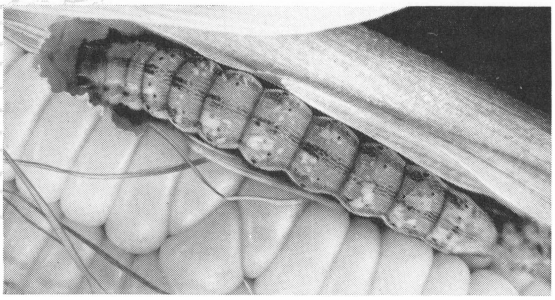




USDA; Hugh Spencer; Bur. of Plant Industry

Corn Smut, *above,* is a fungus disease that turns the kernels of corn into swollen masses of black powder.

The European Corn Borer, *left,* the larva of the moth shown above it, eats its way through corn.



P. S. Tice

The Corn Earworm is a greenish-brown caterpillar that does serious damage to corn, cotton, and other valuable crops.

called corn *cribs*. These cribs have roofs to protect the corn from rain or snow. Corn with much moisture must be dried before it is stored in a crib, or it becomes moldy. In northern areas, where insects do not seriously damage stored corn, farmers store the ears with the husks removed. In the South, some farmers store the ears with the husks still on the ears. The husks help reduce damage by certain insects.

Enemies of Corn. More than 350 kinds of insects feed on the roots, stalks, leaves, and kernels of corn. These pests include the corn earworm, chinch bug, grasshopper, white bug, and European corn borer. Insects take a heavy toll of the corn crop each year. Farmers fight them by spraying or dusting powerful insecticides on the plants. They sometimes mix the insecticides with soil or fertilizer to kill certain pests.

Many kinds of diseases, especially smut and rot, attack corn plants (see Rot; Smut). A combination of disease-free soil, vigorous varieties of corn, and rich, fertile land usually prevents disease and pest trouble.

Farmers protect stored corn from rats and mice by lining the walls and floor of the cribs with wire netting, and by covering the doors and openings with mesh. Some farmers use poisons. Insecticides sprayed on the stored corn help prevent damage by the granary weevil, grain moth, rice weevil, and other insects. These insects attack corn mainly in Virginia, Kentucky, Missouri, and other southern states.

Processing Corn

Milling is the grinding of corn or other seeds. If the grain is soaked and treated chemically before grinding, the process is called *wet milling*. The process of grinding grain while it is dry is called *dry milling*.

Wet Milling. The principal products of wet milling are starch and oil. Cornstarch is important as a food and as a raw material in many industries. Corn oil is used as food for both people and livestock. The wet-milling industry uses about 145 million bushels (3.7 billion kilograms) of corn yearly. Wet millers use mostly yellow dent corn. They can use corn with a fairly high moisture content, because they treat the corn with water.

By-products of wet milling include *zein*, a protein used as a source of many plastics, and *waxy cornstarch*, which is cornstarch made from a special hybrid corn called waxy corn. Some wet-milling processes produce lactic acid, used in the preparation of such foods as cheese, pickles, and sauerkraut. Gluten meal, made from the endosperm of corn kernels, and germ meal, made from the germ, are important livestock feeds.

The water in which wet-milled corn is soaked before preparation is called *steepwater*. It has many uses. It provides a food on which molds and bacteria may grow. Scientists extract penicillin and other antibiotic drugs from the molds, and use the bacteria in yeast production. Steepwater also contains *inositol*, one of the B vitamins.

Dry Milling separates the corn kernel into its parts—hull, endosperm, and germ. Repeated grinding reduces the endosperm to particles of any desired size. The sizes most commonly used include those for hominy grits, corn meal, and corn flour. Grits, or coarse hominy, may be boiled and used as a breakfast cereal, or rolled flat and toasted to make corn flakes. Corn meal is used in bread, griddlecakes, and many other foods. Corn flour has the smallest particles of ground corn. It is used in pancake mixes, as a filler in various meat products, and in baking as a substitute for wheat flour. By-products of dry milling include corn oil and livestock feed.

Dry millers use about 101 million bushels (2.6 billion kilograms) of corn each year. Some corn meal is produced by a method called the *old process*. This meal is sometimes called *waterground*, because many mills use water to provide power. Millers using the old process grind whole corn between rotating stones. Leaving the germ in the meal improves the flavor and nutritional values, but limits the time that the meal stays fresh. Most corn meal sold commercially is made by the *new process*. New-process meal, made from hulled corn kernels with the germ removed, keeps longer than old-process meal. Steel rolls and cylinders and other equipment grind new-process meal.

Distilling and Fermentation industries include manufacturers of ethyl and butyl alcohols, acetone, and whisky. These industries use about 30 million bushels (760 million kilograms) of corn each year. They use the products of both wet and dry milling. Malt and yeast ferment corn, and produce ethyl alcohol and carbon dioxide. The products of fermentation may be distilled to purify them. The grain that remains is used for live-

stock feed. Acetone and butyl-alcohol manufacturers allow bacteria to ferment corn meal. Acetone and butyl alcohol are used in manufacturing rayon, plastics, and other products. By-products of distilling and fermentation include carbon dioxide, corn oil, vitamin and protein concentrates, and grain germ mixtures. See DISTILLING; FERMENTATION.

Livestock-Feed Manufacturing uses more shelled corn than any other industry. This industry also uses such by-products of corn processing as gluten meal, oil meal, and germ meal. The manufacturers grind and mix corn with other feed materials to make various livestock and poultry feeds.

History

Indian Corn. Botanists believe that corn first grew somewhere in North America. Fossilized pollen grains from corn plants found in Mexico may be more than 60,000 years old. Ears of corn about the size of strawberries have also been discovered in Mexico. They may be 3,000 years old.

No one in Europe knew about corn before Columbus sailed to America in 1492. But, when the early explorers arrived from Europe, they found that the American Indians were growing corn from Canada to the southern tip of South America. The Indians grew all the main types of corn that are raised today. They also raised varieties of corn with red, blue, pink, and black kernels. Some kernels had bands, spots, or stripes. The kernels ranged in size from no larger than a grain of wheat to as big as a quarter. Corn played an important part in the religious life of many American Indian tribes. They held elaborate ceremonies when planting and harvesting it, and used corn patterns to decorate pottery, sculpture, and other works of art.

Indians showed the early settlers from Europe how to grow corn. Corn became of first importance to the life of the pioneers (see PIONEER LIFE IN AMERICA [Food]).

Early American colonists often used corn as money. People paid their rent, taxes, or debts in corn, and even traded it for marriage licenses. In settlement after settlement, corn kept people from starving in difficult times.

Improving Corn. Until about 1900, corn grown in the United States was not much different from some of the corn grown by the Indians. But farmers worked to improve the quality of their corn. They tried to grow bigger ears, stronger plants, and more ears on each plant. At first, corn growers simply sowed seeds from the best plants. After many years of selecting only the best seeds, farmers could grow corn that was somewhat better than that grown from ordinary seeds. But even then the results were not always satisfactory.

In the early 1900's, farmers began pollinating corn by hand. They improved the yield of corn by selecting good plants to breed. But they still could not produce uniform plants. George H. Shull (1874-1954), an American geneticist, began studying corn in 1905. He produced the first hybrids while studying heredity in corn. Shull established pure strains of corn by inbreeding, and produced hybrids by crossing the pure strains. Hybrids came into common use about 1933. Scientists continue to try to improve the quality of corn by breeding new hybrids.

Economic Problems. The development of hybrid corn and improved farming methods helped increase U.S. corn production from about 25 bushels per acre (1,569 kilograms per hectare) in the early 1930's to about 87 bushels per acre (5,461 kilograms per hectare) in the early 1970's. Total corn production increased from about 2,300,000,000 bushels (58 billion kilograms) a year to about 5,540,000,000 bushels (141 billion kilograms) a year during that period. Machinery enables farmers to plant, cultivate, and pick more corn. Fertilization and crop rotation improve the soil and increase the crop yield. New insect-killing chemicals destroy many insect pests that attack corn.

This increase in production often results in the production of more corn than the American people can use. The surplus reduces the profits of farmers, because prices drop. In 1933, Congress passed the first law establishing a price-support program for corn and other crops. Several laws passed since then have continued this program. Under it, the government lends money to farmers or agrees to purchase their crops at a given price, called parity (see PARITY). To receive these supports, the farmer must agree to grow only as much corn as the government determines. The government tries to avoid large surpluses by limiting the amount of corn grown.

Scientific Classification. Corn belongs to the grass family, *Gramineae*. It makes up the genus *Zea*, which includes only the species *Z. mays*. But there are many varieties. For example, dent corn is *Z. mays*, variety *indenta*. Sweet corn is *Z. mays rugosa*.

G. F. SPRAGUE

Related Articles in WORLD BOOK include:

Acetone	Corn Syrup	Maize
Alcohol	Cornstarch	Popcorn
Chinch Bug	Farm and Farming	South Africa (picture)
Corn Borer	Furfural	South Dakota (picture: Corn Palace)
Corn Earworm	Hominy	Starch
Corn Meal	Iowa (picture)	
Corn Oil		

Outline

I. Uses of Corn
- A. Livestock Feed
- B. Food for Man
- C. Other Products

II. Kinds of Corn
- A. Dent Corn
- B. Sweet Corn
- C. Flint Corn
- D. Popcorn
- E. Flour Corn
- F. Pod Corn

III. The Corn Plant
- A. Stalk
- B. Leaves
- C. Ears
- D. Natural Pollination
- E. Hand Pollination

IV. Hybrid Corn

V. Growing Corn
- A. Planting
- B. Cultivation
- C. Harvesting Corn
- D. Enemies of Corn

VI. Processing Corn
- A. Milling
- B. Distilling and Fermentation
- C. Livestock-Feed Manufacturing

VII. History

Questions

Why does popcorn pop?

What are the parts of a kernel of corn?

What is the main use of corn? What kind of corn is used for this purpose?

What is the Corn Belt? Why is it well suited for growing corn?

What kinds of corn did the American Indians grow?

What are some different methods of planting corn?

What is hybrid corn? How is it produced?

What is the role of the tassel in reproduction? What is the role of the silk?

What characteristics do breeders try to develop in hybrid corn? Why?

What are the leading corn-growing states?

CORN is a small, hard, shiny thickening of the *epidermis* (outer layer of the skin). This thick growth presses on the *dermis* (deeper skin layer) and causes it to become thin and tender. Pressure and friction cause corns. Therefore, corns often develop over the joints of the toes of persons who wear shoes that do not fit properly. But corns may form anywhere on the body where pressure and friction injure the skin. A *soft corn* is one located between the toes. Here the thickened skin remains soft because it is constantly bathed with sweat.

Corn plasters do not cure corns. To cure a corn, a person must remove the things that caused it to form. But he may use plasters to relieve pain. Most of them contain chemicals that soften the outer horny accumulation and relieve pain. Because of the danger of infection, paring corns with sharp instruments should be done only by a doctor. RICHARD L. SUTTON, JR.

See also CALLUS.

CORN BELT. See CORN (introduction; Growing Corn).

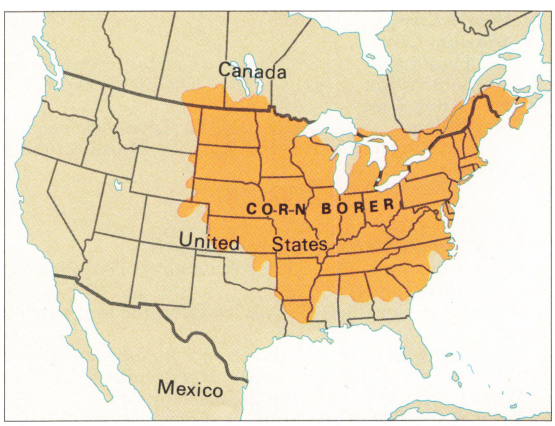
CORN BORER, also called the *European corn borer*, is a serious insect menace to corn crops. The borer is the larva of a night-flying moth. It is pinkish with small brown spots. The female moths begin to lay eggs on corn leaves in early June. The tiny borers feed on the young leaves and tassels. As they grow larger, the borers feed on the stems and ears. One or more generations of borers appear each year, depending on the length of the growing season. In winter, the larvae live in old corncobs, stems, and stubble. The corn borer prefers to eat corn and sorghum. But it attacks other plants, including celery, potatoes, beans, beets, flowers, and weeds.

Farmers destroy corn borers during the winter by feeding cornstalks to livestock, or by shredding or burning the stalks. They plant late in the season to avoid the first flight of the moths, and use hybrid corn plants that are not affected by the corn borer. In some cases, farmers use insecticides.

Scientific Classification. The European corn borer belongs to the snout moth family, *Pyraustidae*. It is genus *Pyrausta*, species *P. nubilalis*. E. GORTON LINSLEY

See also CORN (picture); MOTH (color picture).

CORN CRAKE. See RAIL.



WORLD BOOK map

The Corn Borer came to the United States from Europe about 1910. It spread through the Eastern and Midwestern states, causing damage to the corn crop in the orange areas on the map.

CORN EARWORM, or BOLLWORM, ranks among the worst insect pests in the United States. It costs nearly $100 million a year to fight it. Most corn earworms are greenish-brown with dark stripes. They measure about $1\frac{1}{2}$ inches (4 centimeters) long. The adult is a grayish-brown moth.

On corn, the moths usually lay their eggs on the silk. The eggs hatch in two to eight days. As far north as Kentucky, three broods of corn earworms appear each year—in June, July, and August. Farther north, two broods are normal. To the south, as many as five broods may occur. Corn earworms also attack cotton, tomatoes, alfalfa, beans, and other crops. The corn earworm is called the *bollworm* when it attacks cotton bolls. Insecticides, such as carbaryl, help protect such crops as sweet corn, cotton, and tomatoes. Practical methods have not been developed for field corn.

Scientific Classification. The corn earworm belongs to the owlet moth family, *Noctuidae*. It is genus *Heliothis*, species *H. zea*. E. GORTON LINSLEY

See also CORN (picture); MOTH (color picture).

CORN-HOG FARMING. See AGRICULTURE (Raising Animals); CORN; HOG.

CORN LAWS were measures passed in England between the 1400's and mid-1800's to control the price of small grains, called *corn* in England. The first corn laws prevented grain exports. By the 1500's, landowners could export grain if English prices fell too low. As the population grew in the 1700's, grain imports were permitted if prices rose too high.

By the 1830's, industry was developing in Great Britain, and support grew for the free trade proposals of economist Adam Smith. Landowners had lost support in Parliament. The Anti-Corn Law League, a group of factory owners and workers, wanted the laws repealed so bread would be cheaper. Parliament repealed the corn laws in 1846. Food imports then increased, and British agriculture declined. LACEY BALDWIN SMITH

See also PEEL, SIR ROBERT.

CORN MEAL is made by *milling* (grinding) the *kernels* (seeds) of the corn plant. It may be used in making baked foods and such products as adhesives, cleaning products, and soaps. Manufacturers refine corn meal to produce laundry starch and sizing for fabrics and paper. See also CORN (Uses); CORNSTARCH.

CORN OIL is a vegetable oil product of whole grain corn. About half of the germ, or *embryo*, of each corn grain is oil. To obtain the oil, processors soak the grains in a weak sulfurous acid solution. The softened grain is then cracked and mixed with water, and the oily germ floats off as a layer above the water. After refining, corn oil is used principally as a cooking and salad oil, and in paints and linoleum. See also CORN (Uses).

CORN PONE. See BREAD (Kinds).

CORN SMUT. See SMUT; CORN (picture).

CORN SNAKE. See SNAKE (color picture).

CORN STATE. See IOWA.

CORN SUGAR. See CORN (Other Products).

CORN SYRUP is a thick, sweet liquid made from the starch of corn. It is also called *liquid glucose* or *commercial glucose*. Corn syrup consists of a mixture of dextrin, maltose, and dextrose. It is a chief sweetening agent for candies, gums, and jellies, and is often used to sweeten pancakes and waffles. It varies in color from water-white, to yellow or light brown.

CORNEA. See EYE (The Eyeball).

CORNEAL TRANSPLANTATION. See EYE BANK.

CORNEILLE, *cor NAY y'*, **PIERRE** (1606-1684), was a French playwright. He is often called the father of French tragedy, but he is more truly the founder of French heroic comedy. Corneille favored tragicomedy and melodrama over the conventional tragedy of his day.

Corneille is best known for his tragicomedy *The Cid* (1636). The French Academy condemned the play for breaking several "classical" rules. These "classical" rules held that a play should consist of a single plot in a single location within a day's time. Violence was also prohibited on stage. Although *The Cid* broke these rules, it enjoyed great popularity. It was the first French drama to center interest on the characters' inner psychological conflict rather than on details of the plot. It also brought to the French stage a new lyrical language in keeping with the passionate nature of Corneille's heroes.

The subjects of most of Corneille's plays are taken from Roman history. Most of his leading characters, like their ancient models, show great pride, patriotism, honor, and stern courage. They are fearless, remorseless, and subject to violent emotions such as hatred, revenge, and superhuman ambition. Many of Corneille's plays show the influence of Spanish drama, especially in the passionate, boastful, and violent nature of their heroes.

Corneille's other famous plays include *Horace* (1640), *Cinna* (1641), *Polyeucte* (1642), and *Rodogune* (1644). He described his drama theories in the prefaces to his plays and especially in his *Discourses on Tragedy* (1660). Corneille was born in Rouen. JULES BRODY

CORNELIA was the mother of the Gracchi, political reformers of ancient Rome. See GRACCHUS.

CORNELIAN. See CARNELIAN.

CORNELL, EZRA (1807-1874), was an American businessman and philanthropist. He rose with the rapidly growing telegraphic communications industry, and helped organize the Western Union Telegraph Company. He became a wealthy man, and in his later years devoted his energies and fortunes to educational projects. He is particularly remembered for helping found Cornell University (see CORNELL UNIVERSITY).

Cornell was born in New Britain, N.Y. His father was a poor potter, and he received little education. After several false starts in various fields, Cornell invented a machine that solved Samuel F. B. Morse's problem of laying cable for his first telegraph line. Cornell then became one of the leading builders of telegraph systems. He retired from business at the age of 51. RICHARD D. HUMPHREY

Katharine Cornell
Culver

CORNELL, KATHARINE (1893-1974), an American actress, won fame for the quality of her acting and her fine choice of plays. She became famous in *A Bill of Divorcement* (1921). Beginning with *The Green Hat* (1925), her husband, Guthrie McClintic, directed her performances. Her greatest success came in *The Barretts of Wimpole Street* (1931), which she performed almost a thousand times. She also won praise for her acting in *Romeo and Juliet*, *Saint Joan*, *Candida*, *The Wingless Victory*, *The Three Sisters*, and *Antigone*. Her autobiography, *I Wanted to Be an Actress*, was published in 1941.

Miss Cornell was born in Berlin, Germany, of American parents. Even as a child, the theater fascinated her, and she determined to make it her career. At the age of 18, she began acting with the Washington Square Players in New York City. MARY VIRGINIA HEINLEIN

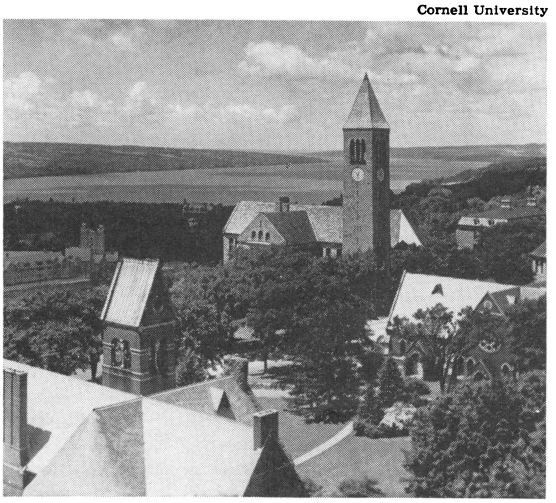
CORNELL COLLEGE. See UNIVERSITIES AND COLLEGES (table).

CORNELL UNIVERSITY is a private school that gets New York state support. The main campus at Ithaca has colleges of arts and sciences, engineering, and architecture. It also has schools of law, hotel administration, education, a general graduate school, and graduate schools of nutrition and business and public administration. The campus has four units of the State University of New York. They are the college of agriculture, the college of human ecology, the veterinary college, and the school of industrial and labor relations. The medical college and the school of nursing are part of the New York Hospital-Cornell Medical Center in New York City. The agricultural experiment station is at Geneva, and the aeronautical laboratory is at Buffalo. Students in the schools of industrial and labor relations, hotel administration, and agriculture are required to work in their chosen fields during the summer months. Statler Hall, at Ithaca, is the "practice inn" for the School of Hotel Administration.

Five of the 45 members of the board of trustees are appointed by the governor of New York. Cornell was founded in 1865 as a land-grant university. It was named for its founder, Ezra Cornell, an American businessman and philanthropist. For enrollment, see UNIVERSITIES AND COLLEGES (table). JOHN MASON POTTER

See also CORNELL, EZRA; NEW YORK (color picture).

The Cornell University Library Clock Tower dominates the wooded campus overlooking Cayuga Lake at Ithaca, N.Y.
Cornell University



CORNER BROOK, Newfoundland (pop. 26,309), is an important newsprint-producing center and the second largest city in the province. It is located on the west coast of Newfoundland in the Bay of Islands near the mouth of the Humber River (see NEWFOUNDLAND [political map]). Corner Brook is the center of one of the world's largest pulp and paper mills. The mill produces about 1,200 short tons (1,090 metric tons) of newsprint and pulp daily. Cement and gypsum are also manufactured in the city. The Humber River is famous for its salmon fishing. Corner Brook has a mayor-council form of government. FRED W. ROWE

CORNERING THE MARKET was a technique formerly used to accumulate all or most of the available supply of a particular stock or commodity. The buyer did this in order to raise the price of the stock or commodity at will. Cornering seriously affected stock-market speculators who *sold short*, or sold stock that they did not own but planned to buy later at lower prices. The market corner forced those who needed a particular stock to go to the controlling group and pay extraordinarily high prices. Various stock exchanges and the Securities and Exchange Commission have outlawed cornering. They limit the prices at which a speculator may sell short, because these practices have caused serious fluctuations in the stock market. G. KEITH FUNSTON

See also BLACK FRIDAY; GOULD (Jay); MARKET.

CORNET, *kawr NEHT*, is a brass-wind treble instrument with a cupped mouthpiece. It looks somewhat like a trumpet, with a main tube almost 5 feet (1.5 meters) long, but it lacks the trumpet's power and brilliance. The tube has three valves operated by sliding rods, or pistons. The tone is produced by the vibration of the player's lips. The pitch is controlled in part by the lips and in part by the pistons. The cornet has a range of about two and one-half octaves. It is used in military and concert bands. It is sometimes used in amateur orchestras in place of the trumpet.

The cornet evolved from the small coiled continental posthorn in the early 1800's in France. Its earliest appearance seems to have occurred during the première of the Italian composer Rossini's opera *William Tell* in 1829. See also TRUMPET. CHARLES B. RIGHTER

CORNFLOWER. See BACHELOR'S-BUTTON; FLOWER (table: National Flowers).

CORNHUSKER STATE. See NEBRASKA.

CORNICE. See ARCHITECTURE (table [Entablature]).

CORNING, N.Y. (pop. 15,792), is a glass-making center on the Chemung River in the south-central part of the state (see NEW YORK [political map]). Corning is often called the *Crystal City*. Products made at the glass works include huge telescope lenses, light bulbs, laboratory apparatus, heat-resisting glass, the famous Steuben glass, and tubes for neon and fluorescent lights. Corning was incorporated as a village in 1848, and as a city in 1890. In 1951, the Corning Glass Works opened the Corning Glass Center, which has exhibits on the history of glass. Corning has a mayor-council government. See also GLASSWARE (Present-Day Art Glass). WILLIAM E. YOUNG

CORNPLANTER (1740-1836) was a Seneca Indian chief. He fought the colonists during the Revolutionary War, but later supported the United States. Trusted by both Indians and settlers, Cornplanter helped arrange several treaties that brought peace to the frontier. The grateful Pennsylvania legislature voted a grant of land to Cornplanter near what is now Warren. The Cornplanter tract is now covered by the waters of a huge dam built to control floods on the upper Allegheny River. Cornplanter was born in what is now New York state, near the Genesee River. S. K. STEVENS

CORNSTALK (1720?-1777) was a Shawnee Indian chief during colonial days. He led an uprising against the white settlers in western Virginia in 1774. Troops sent by Lord Dunmore, the British governor of Virginia, defeated Cornstalk at the Battle of Point Pleasant in October, 1774. The battle ended what became known as Lord Dunmore's War and resulted in a treaty that lasted until 1777. Then, the British began inciting the Indians to attack white settlers. Cornstalk went to Point Pleasant to warn the settlers, but they held him as a hostage. After the Indians ambushed a soldier, the settlers killed Cornstalk and his son. A monument to Cornstalk stands in Point Pleasant. JAMES GAY JONES

CORNSTARCH is a fine white flour made by grinding and refining grains of corn. It is made of corn from which the seed-bearing part, called the *germ*, has been removed. The corn is ground in a process called *wet milling*. The cornstarch is then dried in ovens for marketing. Since only 10 per cent of moisture remains in the cornstarch after the drying process, it is often mixed with other foods to protect them from moisture. Manufacturers use cornstarch in bakery products, baking powder, candies, and salad dressing. Cooks use it to thicken gravies and puddings. Cornstarch is also used in asbestos products, explosives, paints, and textiles. See also CORN (Milling). LEONE RUTLEDGE CARROLL

CORNU, PAUL. See HELICOPTER (Manned Flights).

CORNUCOPIA is a horn of plenty, symbol of nature's productivity. According to Greek mythology, there are two stories about its origin. In one, Hercules and a river-god had a contest. When the river assumed the form of a bull, Hercules wrenched off one of its horns and filled it with flowers for the goddess of plenty. In the other account, the infant Zeus was fed by the milk of a goat. Zeus gave one of the goat's horns to his nurses as a memorial of their care. The horn could be filled with whatever the owner wished. CHARLOTTE E. GOODFELLOW

CORNWALL. See ENGLAND (political map).

CORNWALL, Ont. (pop. 47,116), stands on the north bank of the St. Lawrence River in eastern Ontario (see ONTARIO [political map]). Cornwall's industries include a chemical factory and rayon and paper mills. Canada's St. Lawrence Seaway Authority headquarters are in Cornwall. Cornwall was founded in 1784 by the United Empire Loyalist settlers. It was chartered as a city in 1945. D. M. L. FARR

CORNWALLIS, *kawrn WAHL ihs*, **CHARLES** (1738-1805), FIRST MARQUIS CORNWALLIS, was a British general in the Revolutionary War. His surrender at Yorktown in 1781 ensured the American triumph.

Cornwallis helped capture New York in 1776, then pursued General George Washington across New Jersey. He became second in command to Sir Henry Clinton in 1778. In 1780, he directed the southern campaign. Invading North Carolina, he defeated General Nathanael Greene at Guilford Courthouse. Then, against Clinton's wishes, he moved into Virginia. Finally, a French fleet

and French and American troops surrounded him at Yorktown. Cornwallis' forces surrendered there on Oct. 19, 1781.

Cornwallis was commander in chief and governor-general of India from 1786 to 1793 and again in 1805. He also served as viceroy and commander in chief of Ireland from 1798 to 1801. Cornwallis was born in London on Dec. 31, 1738. W. B. Willcox

CORNWALLIS, EDWARD (1713-1776), a British soldier and colonial official, led 2,500 settlers to Nova Scotia in 1749 and founded Halifax. The city became Nova Scotia's capital in the same year. He served as governor and captain-general of Nova Scotia from 1749 to 1752. Cornwallis served in the British army from 1731 to 1748. He was appointed governor of Gibraltar in 1762 and served there until his death. Cornwallis was born in London. Charles Bruce Fergusson

See also Canada, History of (color picture).

COROLLA. See Flower (The Parts of a Flower).

CORONA, *kuh ROH nuh*, in astronomy, is the layer of thin gases that makes up the outer atmosphere of the sun. Parts of the corona extend at least 8 million miles (13 million kilometers) from the sun's surface.

The corona changes in size and shape with sunspot activity (see Sunspot). Scientists estimate that the temperature of the inner corona—the part nearest the sun—reaches 2,000,000° to 3,000,000° F. (1,100,000° to 1,700,000° C). But the gases that make up the corona are so thin that the corona actually contains little heat (see Heat [Temperature and Heat]).

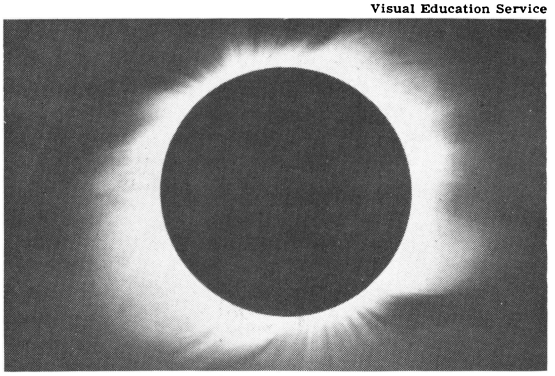
The inner corona shines about half as brightly as the full moon. Most of its light comes from sunlight scattered by electrons. But the unaided eye cannot distinguish the corona's light from surrounding space because the sun itself makes the corona's light unnoticeable.

During a total solar eclipse, the moon blots out the sun, allowing the light of the corona to be seen by the unaided eye. Scientists can study the inner corona at other times through special telescopes called *coronagraphs*. A disk in the coronagraph blocks the direct rays of the sun. Eric D. Carlson

See also Sun; Eclipse.

The Sun's Corona, as Seen During a Total Eclipse

Visual Education Service

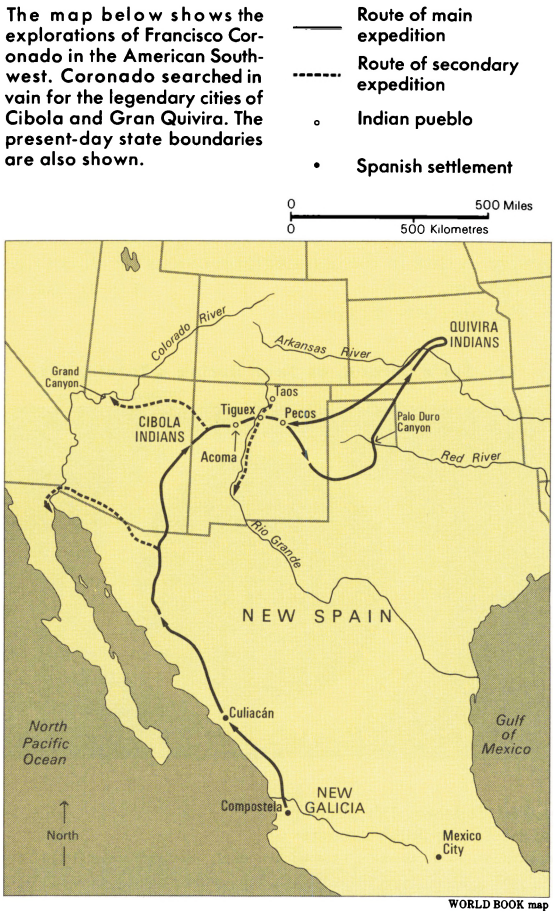


Lord Cornwallis Surrendered His Army to George Washington at Yorktown. This painting shows French and American officers, including Washington, lined up to receive the British surrender.

The Surrender of Lord Cornwallis at Yorktown (1817-1824), an oil painting by John Trumbull; Yale University Art Gallery

CORONADO'S EXPEDITION 1540-1542

The map below shows the explorations of Francisco Coronado in the American Southwest. Coronado searched in vain for the legendary cities of Cibola and Gran Quivira. The present-day state boundaries are also shown.



WORLD BOOK map

CORONADO, *koh roh NAH thoh,* or *kahr oh NAH doh,* **FRANCISCO VÁSQUEZ DE** (1510-1554), a Spanish explorer, led an expedition into the American Southwest, in search of the Seven Cities of Cibola and Gran Quivira. Explorers and Indians reported these cities to be rich in gold. Coronado, with a force of 300 Spaniards and several hundred Indians, began his search early in 1540. He visited what is now Arizona and New Mexico, and found Indian pueblos, but no golden cities.

The following spring, Coronado led his army across the Great Plains into what is now Kansas. He discovered the Palo Duro Canyon near present-day Amarillo, Tex. He saw big buffalo herds grazing on the plains. He found Indians called Quiviras, but no sign of gold.

Although Coronado failed to find the cities, his exploration of the Southwest proved valuable. The expedition discovered the Continental Divide, which runs through the Rocky Mountains. Some of his men, on a separate trip, discovered the Grand Canyon.

Coronado was born in Salamanca, Spain. He went to Mexico in 1535, and became governor of New Galicia, northwest of Mexico City, in 1538. RICHARD A. BARTLETT

See also KANSAS (Exploration).

CORONAGRAPH. See CORONA.

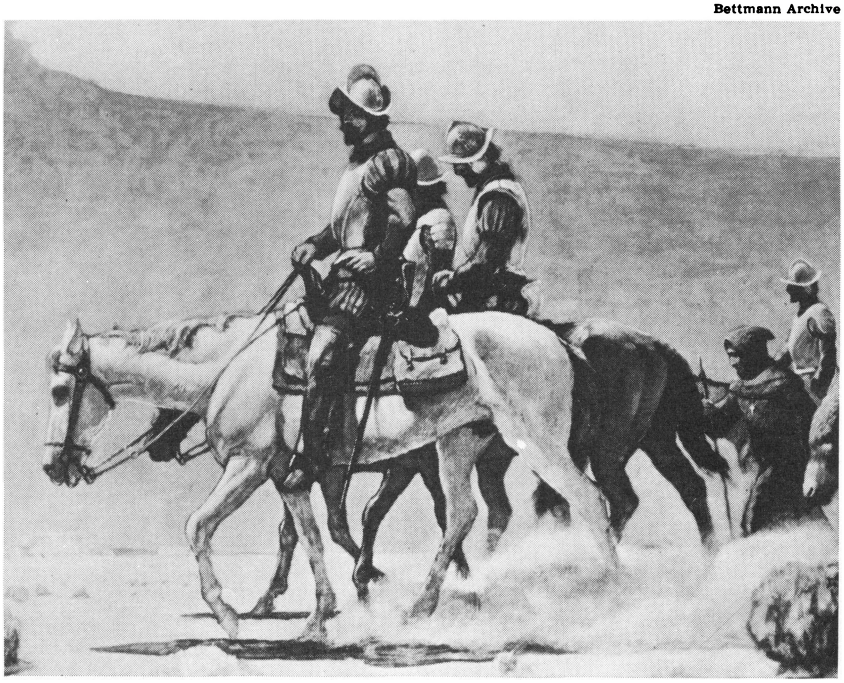
CORONARY THROMBOSIS is a condition in which a clot blocks the passage of blood in an artery of the heart. This condition is also called a *heart attack,* a *coronary occlusion,* or a *myocardial infarction.*

Symptoms of a coronary thrombosis include severe chest pain, shortness of breath, vomiting, and a weak and rapid pulse. The chest pain is called *angina pectoris* (see ANGINA PECTORIS).

A coronary thrombosis can cause death. If the patient survives, the condition leaves scar tissue in the area surrounding the artery where the clot blocked the blood vessel. VINCENT V. GLAVIANO

See also HEART (Arteriosclerosis; Heart Attacks).

Bettmann Archive



Francisco Coronado, shown in a painting by N. C. Wyeth, set out in 1540 to search for seven cities that were said to be stocked with gold and gems. Instead, he discovered parts of the Rio Grande, the Grand Canyon, and central Kansas.

United Press Int.

Queen Elizabeth II's Coronation took place in Westminster Abbey in London on June 2, 1953. The Archbishop of Canterbury placed St. Edward's Crown on Elizabeth's head as she sat in the Coronation Chair. The queen wore a cloak of gold cloth. She held a rod with a dove in her left hand and a scepter with a cross in her right hand.

CORONATION is a ceremony at which a king, queen, or pope publicly receives a crown as a symbol of rule. The ceremony is usually rich in color and tradition. Most coronations have religious as well as political features, and a religious official often performs the ceremony. During the proceedings, the new ruler also receives other official marks of royalty. When accepting this power, he usually makes a solemn pledge to rule wisely.

The British Coronation includes many features common to coronation ceremonies in other countries. The British ceremony takes place in Westminster Abbey. The new monarch is conducted from the west door of the Abbey along the nave to the crossing, where the ceremony is performed. First, the monarch sits in a Chair of Estate. The *regalia*—the crown, orb, scepter, rod, swords of state, spurs, ring, and bracelets used in the ceremony—are placed on the altar. The Archbishop of Canterbury then presents the monarch to the people in the abbey as the true ruler of the realm. The monarch takes the coronation oath, swearing to rule justly and to support the Church of England. The monarch receives a Bible, which is placed on the altar. The celebration of the communion service of the Church of England then begins.

The service is interrupted after the Creed, the cloak is removed, and the monarch moves to King Edward's Chair, also called the Coronation Chair. Here the monarch is anointed and clothed in a cloak of gold cloth. The spurs of St. George, a symbol of knighthood, are presented. The Sword of State is taken from its scabbard and carried before the monarch during the rest of the ceremony. *Armills* (bracelets) are put on the wrists of the monarch. While sitting in King Edward's Chair, the monarch receives the *orb*, a globe of gold surmounted with a cross signifying the rule of Christ over the world. The Coronation Ring, symbolizing the marriage of the ruler and the kingdom, is placed on the monarch's right hand. The monarch receives a rod with a dove to hold in the left hand. The dove symbolizes the Holy Ghost. The monarch holds a scepter with a cross in the right hand. On top of the scepter is the *Star of Africa*, the largest cut diamond in the world. After the monarch receives these various symbols of authority, the Archbishop of Canterbury places the crown of St. Edward on the monarch's head.

The guns of the Tower of London fire a salute in honor of the coronation. The peers and peeresses, who were bareheaded until this moment, place their coronets and caps on their heads. The monarch moves to the throne after receiving a blessing from the archbishop. Nobles, carrying the Jewelled Sword of State, the Sword of Temporal Justice, the Sword of Spiritual Justice, and the Sword of Mercy, which has a blunted point, surround the throne. The monarch gives the rod and scepter to an attendant, then receives homage and fealty from representatives of the clergy and the public.

The monarch then leaves the throne, removes the crown, and offers the archbishop the bread and wine for Holy Communion. An altar cloth and an ingot of gold are placed on the altar. The monarch takes Holy Communion and returns to the throne. Then the monarch receives the crown, the scepter, and the orb, and leaves the throne. After walking in procession down the

United Press Int.

The Coronation Procession of Queen Elizabeth II centered on the royal coach drawn by eight perfectly matched horses.

nave, the monarch leaves the Abbey through the west door. A banquet follows the coronation. In earlier times a fully armed knight, the King's Champion, rode into the banquet hall to challenge anyone who questioned the monarch's right to the throne.

The British coronation ceremony is quite ancient. The earliest record of the ceremony used in the coronation of an English king dates from about the A.D. 750's. King Edward I (1272-1307) made the Coronation Chair to contain the *Stone of Scone* (or *Stone of Destiny*), the Coronation Stone of ancient Scottish kings.

Development. Ancient Germanic tribes elected their rulers. The newly elected king received a spear, and a diadem of silk or linen was placed on his forehead. As the king sat upon a shield, his warriors lifted him to receive the acclamation of his followers.

Religious pageantry, taken from the Bible, influenced coronation ceremonies after the birth of Christianity. According to a custom mentioned in the Bible, kings were anointed with *chrism*, a mixture of oil and balm. People thought that chrism gave the anointed ruler special miraculous powers. In England, popular belief held that a person who even touched the king's clothes could be cured of illness. In some coronation ceremonies, the ruler was ordained as one of the lower ranks of the clergy. The Holy Roman emperor became a subdeacon and canon of St. Peter's Church and St. John Lateran in Rome. I. J. SANDERS

Related Articles in WORLD BOOK include:

Charlemagne (Crowned as Emperor)	Napoleon (Crowned Emperor)
Crown	Pope (The Coronation)
Elizabeth II (picture)	Scone, Stone of
	Westminster Abbey

CORONER, *KAWR uh nuhr*, is an officer whose chief duty is to investigate any death which appears not to be from natural causes. In many states, he must be a physician, and may also serve as medical examiner. The coroner may be assisted by a jury of six or more men in his attempt to discover the cause of death. The report made by the coroner and the jury is used as a basis for possible arrests. The first coroners were those of early France and England. They guarded the fines collected by the king, or crown, and were called *crowners*. From this title came *coroner*. See also INQUEST. H. F. ALDERFER

COROT, *KAW ROH*, **CAMILLE** (1796-1875), was a French landscape and figure painter. His work formed an artistic bridge between the tradition of classical composition of the early 1800's and the romantic movement's concern with nature which led to impressionism.

Corot began to study painting against his parents' wishes. In 1825, he went to Italy, where he became concerned with the play of light and color values. He began painting in solid masses in order to produce light and dark patterns of color. Corot's early work shows the influence of the French landscape painters, Claude (Lorrain) and Nicolas Poussin, and of the Dutch landscape painters of the 1600's.

Corot returned to France in 1828 and traveled a great deal, because a small income left him free from economic worries. He came under the influence of a group of nature painters in the village of Barbizon. Corot was called "the lyric poet" of this group. He changed his style, and began painting everything as if seen through a delicate gray veil, accented by a few details of bright color. Corot's style underwent a final change in 1871. He again painted in the style of his youth, but his works were now drenched in impressionist light and color. His painting, *A View near Volterra*, appears in color in the PAINTING article.

Corot painted portraits for his own pleasure throughout his career. He also painted religious pictures. His portraits, along with his early and last paintings, are considered his best works. Corot was born Jean Baptiste Camille Corot in Paris, the son of a successful hairdresser. ROBERT GOLDWATER

CORPORAL. See RANK IN ARMED SERVICES.

CORPORATION is an organization that can own property and make contracts as if it were a person. The property and contracts belong to the organization, not to the individuals who form it. Those who invest in a corporation have *limited liability*. If the corporation fails, they can lose no more than their investment, because the corporation's debts are not their debts.

In the United States, a corporation cannot be formed without the permission of the state or federal government. National banks must get federal government approval, but most corporations are chartered by a state government. A corporation set up in one state can

do business in other states if its officers file certain forms and pay required fees in those states.

Corporations are formed under *general incorporation laws*. Persons wishing to form a corporation file *Articles of Incorporation*, stating the purpose and makeup of the organization. A state official then issues a certificate that permits the corporation to exist.

Stock Corporations own most large businesses and many small ones. A stock corporation is made up of persons who invest in the business by buying shares of the corporation's *capital stock*. These investors are called *stockholders*. The corporation distributes profits among the stockholders. These individual portions of the profits are called *dividends*.

The persons who form a corporation decide how many shares of stock will be issued and how much each will cost. After the corporation is formed, a stockholder usually may sell his stock to anyone else. The price generally depends on how well the company is doing (see STOCK, CAPITAL).

A corporation is governed by a board of directors, elected by the stockholders. Ordinarily, each stockholder can cast one vote for every share of stock he owns. As a result, a person owning 51 per cent of the stock can outvote all other stockholders, no matter how many there are. Some corporations issue certain *nonvoting stock*. Owners of this stock cannot vote.

The voting stockholders elect directors at regular meetings. If a stockholder does not wish to cast his vote in person, he may give another person written permission to cast it for him. That person is called a *proxy* (substitute). The written permission is also called a proxy. Sometimes, groups of stockholders compete for control of a corporation. Each group tries to collect proxies from other stockholders. The group holding the most proxies can elect the directors it favors.

The directors establish the policies of a corporation. The policies are carried out by officers, such as a president, vice-president, secretary, and treasurer. In most corporations, the directors choose the officers. In some, the stockholders elect the officers.

Parent and Subsidiary Corporations. A corporation may own all or most of the stock of another corporation. The corporation owning the stock is generally called a *parent corporation*, or *holding company*. The other corporation is called a *subsidiary*. Most subsidiaries are businesses related to the business of the parent company. For example, a firm that makes automobiles may have a subsidiary that makes automobile parts.

Membership Corporations are formed without issuing stock. Instead of stockholders, they have members who elect the directors. Membership corporations include churches, cooperatives, country clubs, and community service organizations, such as the Red Cross or the Young Men's Christian Association (YMCA). They often are called *nonprofit corporations*.

Municipal Corporations include cities, counties, or school districts that run the business of communities. As a rule, their governing bodies, such as city councils or school boards, are elected by the voters of the community.

ROBERT E. RODES, JR.

Related Articles in WORLD BOOK include:

Bond	Charter	Franchise
Bylaw	Conglomerate	Holding Company
Cartel	Excess-Profits Tax	Investment
Joint-Stock Company	Monopoly and Competition	Proxy
Limited Company	Multinational Corporation	Stock, Capital
Manufacturing (tables)	Partnership	Trust

CORPS, *kawr*, is an army unit consisting of two or more divisions. The term *corps* comes from *corpus*, which is the Latin word for *body*. A corps is normally composed of about 65,000 to 90,000 soldiers, but the size can vary. A corps is usually commanded by a lieutenant general. A corps can conduct major military operations.

The word *corps* also refers to the United States Marine Corps and to such branches of the United States Army as the Corps of Engineers, the Medical Corps, and the Signal Corps.

See also ARMY (Major Armies of the World); ARMY, UNITED STATES (table: Army Levels of Command).

CORPS OF ENGINEERS. See ENGINEERS, CORPS OF.

CORPUS CHRISTI, *KAWR puhs KRIHS tih*, Tex. (pop. 204,525; met. area 284,832), is a major United States seaport and a center of industry and tourism. It lies on Corpus Christi Bay, near the Gulf of Mexico. For location, see TEXAS (political map). The city was named for the bay.

Description. Corpus Christi, the county seat of Nueces County, covers about 325 square miles (842 square kilometers). This area includes 221 square miles (572 square kilometers) of inland water. About half the people of Corpus Christi have Mexican or Spanish ancestry.

Corpus Christi has a mild climate and attracts many tourists and conventions. Temperatures in the city average 57° F. (14° C) in January and 84° F. (29° C) in July. For the monthly weather in Corpus Christi, see TEXAS (Climate). The city has fine facilities for fishing, sailing, and swimming, and crowds of tourists visit nearby Padre Island National Seashore.

Cultural attractions in Corpus Christi include the Art Museum of South Texas, the Corpus Christi Museum, and the Museum of Science and History. The city also has a symphony orchestra. A campus of Texas A&I University is in Corpus Christi.

The Port of Corpus Christi handles about 30 million short tons (27 million metric tons) of cargo yearly. Ocean-going ships reach the port via a 21-mile (34-kilometer) channel that links the city with the Gulf of Mexico. The port serves barges that use the Gulf Intracoastal Waterway, which runs along the coastline between Brownsville, Tex., and Carrabelle, Fla. Three airlines use Corpus Christi International Airport.

Corpus Christi lies near major natural gas and petroleum fields and fertile farmland. The city's chief manufactured products, in order of value, are chemicals, petroleum and coal products, and processed foods. The Corpus Christi Naval Air Station ranks among the chief employers of the city's workers.

History. Karankawa Indians lived in what is now the Corpus Christi area before white men arrived. About 1839, Henry L. Kinney, a Pennsylvania merchant, opened a trading post at the site to serve nearby ranchers. The settlement was named Corpus Christi about 1848 and was incorporated as a city in 1852.

Corpus Christi grew slowly until the 1920's. In 1923,

the city developed its first natural gas well. The port opened in 1926. Corpus Christi's population increased from 10,522 to 27,741 during the 1920's. The discovery of nearby oil deposits in 1930 helped raise the population to 57,301 by 1940.

The Corpus Christi Naval Air Station opened in 1941 and trained 40,000 naval fliers during World War II. After the war ended in 1945, the large supplies of natural gas and petroleum in Nueces County attracted many industries to Corpus Christi. By 1960, the population of the city had grown to 167,690. Corpus Christi has a council-manager government. WALTER B. MOORE

CORPUS CHRISTI, a feast. See DRAMA (Religious Plays; picture); QUEBEC (picture: Corpus Christi Religious Festival).

CORPUS CHRISTI NAVAL AIR STATION, Texas, houses the headquarters of the Naval Air Advanced Training Command. The station covers 5,258 acres (2,128 hectares), and lies 8 miles (13 kilometers) from the center of Corpus Christi. After basic training, naval pilots receive advanced training in multi- and single-engined fleet aircraft there and at other air stations. The base was set up in 1941. In World War II, it trained about 40,000 naval aviators. JOHN A. OUDINE

CORPUS JURIS CIVILIS. See JUSTINIAN CODE.

CORPUSCLE, *KAWR puh suhl*, in physiology, is a term used for a small mass or body. It is often used to mean *cell*, especially in referring to the red cells and white cells of the blood. Certain parts of the nervous system, such as the nerve endings in the skin that respond to pressure, are called *corpuscles* (see BLOOD [Parts of the Blood]).

CORPUSCULAR THEORY. See LIGHT (Man's Understanding of Light).

CORRAL. See RANCHING (Life on a Cattle Ranch); COWBOY (Branding Cattle).

CORREGGIO, *kuh REHJ oh* (1489-1534), was a great painter of the Italian Renaissance. His most important works were his *frescoes* (wall paintings) on the insides of the domes of two churches in the city of Parma, Italy. These frescoes represent heavenly visions and create illusions of the church ceilings opening into the sky. Dramatic feeling and a complex mingling of clouds and figures characterize both frescoes. Their style strongly influenced the revival of religious art during the baroque period of the 1600's (see BAROQUE).

Correggio's style shows the influence of the Italian painters Raphael and Leonardo da Vinci. But Correggio's paintings have a more spirited emotional feeling and a more delicate handling of light and shadow than the work of those masters. Correggio took his name from his birthplace of Correggio. His real name was Antonio Allegri. SAMUEL Y. EDGERTON, JR.

CORREGIDOR, *kuh REHG ih dawr*, a rocky fortified island, covers about 2 square miles (5 square kilometers) at the entrance to Manila Bay on the island of Luzon. It is sometimes called the *Gibraltar of the Pacific*. The island has a population of about 65. During the early days of World War II, United States and Filipino troops made a determined stand on Corregidor against overwhelming Japanese forces. Their surrender to enemy troops on May 6, 1942, marked the end of organized U.S. resistance in the Philippines.

The Japanese held Corregidor until U.S. troops freed Luzon in February, 1945. The U.S. ceded Corregidor to the Republic of the Philippines in 1947. In 1963, the United States and the Philippines agreed to develop Corregidor into a battlefield park as a World War II memorial. STEFAN T. POSSONY

CORRELL, CHARLES. See RADIO (The Golden Age of Broadcasting; picture).

CORRESPONDENCE. See LETTER WRITING.

CORRESPONDENCE SCHOOL is an educational institution that furnishes home-study material through the mail. Over 3,500,000 persons are enrolled in more than 750 home-study schools in the United States. About 75 per cent of the courses are of the vocational type.

Colleges and universities provide correspondence courses for nearly 200,000 persons. They coordinate their programs through the National University Extension Association. Government agencies, the armed forces, religious institutions, and business and industry provide courses for over 1,700,000 persons.

Nearly 1,500,000 persons are enrolled in private home-study schools. The National Home Study Council was organized in 1926 by a group of home-study schools. It works with the National Commission on Accrediting and the Federal Trade Commission to maintain sound educational standards and business practices. The 59 accredited schools in the council have an enrollment of about 1,200,000 persons.

The University Extension movement in England first used the correspondence plan in 1868. The earliest practical courses in the United States were developed in 1892 by President William R. Harper of the University of Chicago. The Blackstone School of Law in Chicago, and the International Correspondence School in Scranton, Pa., founded in 1891, are pioneer correspondence schools still in existence. THOMAS J. MCLERNON

See also EXTENSION SERVICE.

Oil painting of the late 1520's; The Louvre, Paris

Correggio's *The Mystic Marriage of Saint Catherine* shows the artist's soft treatment of flesh, his command of gentle light, and his delicate handling of shading. Correggio influenced painters of the baroque style in the 1600's.

CORRESPONDENT. See FOREIGN CORRESPONDENT; WAR CORRESPONDENT.

CORROBOREE is an Australian aborigine dance festival. See AUSTRALIA (picture: Aborigine Tribesmen).

CORRODENTIA is an order of destructive insects commonly called book lice, bark lice, or dust lice. They infest homes, libraries, and museums, damaging books by eating the paste and glue in the bindings. Out of doors, they eat refuse. See BOOK LOUSE; INSECT.

CORROSION, *kuh ROH zhun*, is the gradual chemical breakdown of metals or rocks. A corroding metal or rock reacts slowly with some substance such as oxygen or an acid. This reaction alters the metal and often makes it useless. Corrosion in iron and steel is called *rusting*. Metals laid underground may be corroded by chemicals in the soil. Gases, such as sulfur dioxide in smoke, sometimes cause corrosion. Corrosion may be dangerous when it occurs in gas pipes or in high pressure boilers. See also OXIDATION; RUST.

Corrosion can often be prevented by coating the metal with paint. The metal may be mixed with another substance to produce an alloy that does not corrode. Corrosion can also be prevented by covering the metal with a noncorroding metal.

CORROSIVE SUBLIMATE. See BICHLORIDE OF MERCURY.

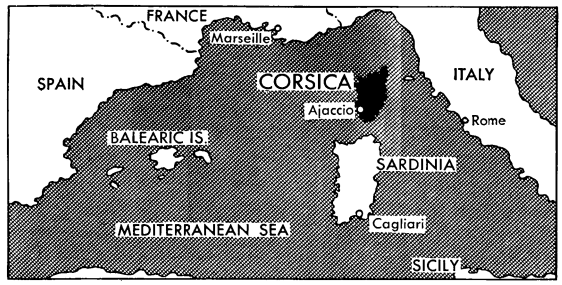
CORRUPT PRACTICES are unethical techniques used by politicians to gain a political advantage in an election. The term is most commonly used in referring to federal and state legislation, called *corrupt practices acts*, that govern campaigns and elections. These laws prohibit such activities as bribery, ballot-box stuffing, tampering with voting machines, and threatening or impersonating voters. Many of these laws also govern party campaign finances. For example, many states have laws that limit the amount spent by candidates and parties in state and local elections. The Federal Election Campaign Act of 1971 limits spending by candidates in federal elections, but not the amount spent by parties. Congress passed the law to prevent money from playing a dominant role in getting candidates elected to federal office. Previous laws that limited such spending had been easy to evade. ROBERT A. DAHL

CORRUPTION OF BLOOD. See ATTAINDER.

CORSICA, *KAWR sih kuh* (pop. 269,831), is a French island in the Mediterranean Sea. It lies 9 miles (14 kilometers) north of the island of Sardinia, between southeastern France and northwestern Italy. Corsica's name in French, the official language, is CORSE. The island is one of the *departments* (main administrative districts) of France. It is famous as the birthplace of Napoleon.

Size and Description. Corsica has an area of 3,352 square miles (8,682 square kilometers), and ranks as the fourth largest island in the Mediterranean. Its 275-mile (443-kilometer) coastline is high and craggy, and there are few natural harbors. The wild, rocky interior is covered with scrub and cut by narrow, fertile valleys. Ajaccio, the capital of Corsica, lies on the western side of the island beside the Gulf of Ajaccio. Bastia, Corsica's largest city, lies on the island's eastern side.

Economy. Corsica has a mild climate, and crops flourish in the rich soils of the valleys. Farmers raise olives, grapes and other fruits, grains, vegetables, and tobacco. Cork, pine, oak, and chestnut trees cling to the steep slopes of the mountains. Corsicans grind chestnuts into meal to make bread. Wool for clothing comes from sheep that graze in the mountains. Along the coast, the people fish for sardines and hunt for coral. Miners quarry granite and marble in the mountains. Some iron, lead, and copper are also mined. Since World War II, Corsica's principal exports have been wool and cheese. The island's fastest-growing source of income is the tourist trade. Tourists enjoy the climate, the rugged scenery, and the colorful villages.



The Island of Corsica Lies in the Mediterranean Sea.

History. Corsica was first settled about 560 B.C. by Phoenicians, who called the island *Cyrnos*. It was conquered in turn by Etruscans, Carthaginians, and Romans. The Romans renamed the island Corsica. Vandals captured Corsica in A.D. 469, but it was recaptured by Rome, under Justinian the Great, in 534. Later, Corsica came under the rule of Charlemagne.

Pope Gregory VII assumed sovereignty of Corsica in 1077, and granted it to the Bishop of Pisa to control. About 300 years later, Corsica came under the control of the Italian city of Genoa. In 1768, the Genoese ceded the island to the French, who lost it to the British in 1794. In 1796, Napoleon sent an expedition to Corsica to re-establish French control. France has held the island since then, except for a brief occupation by British soldiers in 1814, and the occupation by Italians and Germans during World War II. Allied forces freed the island in 1943, and it again became part of the French Republic. EDWARD W. FOX

CORTES. See SPAIN (Government).

CORTES, *KAWR tehz*, or *kawr TAYS*, **HERNANDO** (1485-1547), was a Spanish adventurer who conquered Mexico. He was probably the greatest Spanish conqueror in the Americas. His name is often spelled CORTEZ.

Cortes was born in Estremadura, Spain. He went to Santo Domingo in the West Indies in 1504, and took part in the conquest of Cuba in 1511. The governor of Cuba became interested in the mainland to the west of the island. He chose Cortes to command the small fleet and army that he was sending to the area to explore and look for treasure.

Cortes and his expedition of about 650 Spaniards explored the coast of Yucatán and, early in 1519, landed on the coast of Mexico. There, Cortes founded the settlement of Veracruz. He scuttled all his ships except one, which he sent to Spain to report to the king concerning the plans for conquest. He destroyed the vessels because he wanted to add their crews to his small army.

Conquest of the Aztec. Cortes left soldiers to guard Veracruz, then led the main force overland to Tenochtitlán (Mexico City), the capital of the powerful and highly civilized Aztec Indians. The Aztec had conquered most of the nearby tribes. Cortes was received

graciously by Montezuma, the Aztec ruler, who secretly feared the white men. But Cortes soon made Montezuma a prisoner and used him to govern the country. A larger Spanish expedition landed at Veracruz, and Cortes persuaded most of the men in the expedition to join him.

Detail of an oil portrait (1525) by an unknown artist; Instituto Nacional de Anthropologia e Historia, Mexico City

Hernando Cortes

The Aztec, angered by Montezuma's submission to Cortes, renounced his rule and attacked the Spaniards in Tenochtitlán. Cortes had superior weapons and slaughtered Aztec warriors by the thousands, but they were so numerous that he had to withdraw from the city. The Indians pursued him, and Cortes and his soldiers were in danger of being wiped out. But the Aztec general died, and the leaderless Indians fled.

The Spaniards retired to a friendly Indian city, where Cortes received reinforcements from the West Indies and from many Indian groups who hated the Aztec because of their bloodthirstiness and cruelty. With this increased army, Cortes captured Tenochtitlán in 1521 and ended the Aztec nation.

Later Work. Cortes spent the next few years spreading Spanish rule over other cities and districts. He governed Mexico, then called New Spain, for a time. The king of Spain entitled him Marquis of the Valley. In 1536, he commanded an expedition that founded the first settlement in Lower California.

Cortes eventually fell out of favor with the king and returned to Spain in 1540 to plead his own cause. He failed in his attempt to have his rights restored, and died in a village near Seville. CHARLES EDWARD NOWELL

See also AZTEC; CUAUHTÉMOC; MONTEZUMA.

Drawing with colored ink on parchment by an unknown artist; Biblioteca Apostolica Vaticana (Vatican Library)

Hernando Cortes conquered Mexico for Spain in the early 1500's. The manuscript in picture writing, *above*, shows Cortes meeting the Aztec ruler Montezuma in 1519. An Aztec artist created the manuscript at Montezuma's request.

CORTEX. See BARK; GLAND (The Adrenal Glands).

CORTEX, CEREBRAL. See BRAIN (The Cerebrum).

CORTINA, JUAN NEPOMUCENO (1824-1894), was an early leader of the civil rights struggle of Mexican Americans. He fought the unfair treatment received by Mexican Americans in Texas following the Mexican War (1846-1848). Cortina became a Mexican folk hero and was called the "Robin Hood of South Texas."

Cortina was born near Brownsville, Tex., when Texas still formed part of Mexico. As a young man, he became angry at the attempts of English-speaking Americans to deprive Mexican Americans of their property. Many Mexican Americans did not understand the property laws of the United States. Those who did not register their land with the state or pay property taxes lost their land. Most courts did not protect the rights of Spanish-speaking people.

In September, 1859, Cortina led about 100 men in a raid on Brownsville. His band killed three men who had abused Mexican Americans. Cortina led other raids in Texas until U.S. troops chased him into Mexico in 1860. From 1869 to 1876, Cortina served as governor of the Mexican state of Tamaulipas. He also became a brigadier general in the Mexican army. FELICIANO RIVERA

CORTISONE, *KAWR tuh zohn*, is one of a large family of compounds that are normally made in the *cortex*, or outer portion of the adrenal glands. Cortisol is another closely related member of the family. Cortisone is essential for normal life. It has a marked effect on the formation and use of sugar in the body. It increases resistance to cold and other stresses. In patients who have lost the use of their own adrenal glands, these compounds restore strength, health, and a feeling of well-being.

Cortisone was first used at the Mayo Clinic in Rochester, Minn., by Philip S. Hench and Edward C. Kendall to treat patients with rheumatic fever and one form of rheumatism. These men received the 1950 Nobel prize in physiology and medicine for their work with this substance. (They shared the prize with Tadeus Reichstein, who first isolated cortisone.) Further investigation showed that cortisone was valuable in treating many other diseases. Among these were allergic and inflammatory conditions, asthma, disorders of the eyes and skin, and diseases of the gastrointestinal tract and the kidneys. Cortisone can be used effectively in more different diseases than any other substance.

The adrenal glands were the only source of cortisone for 12 years after the substance was discovered. Cortisone was expensive and the supply was small. But in 1948, scientists produced cortisone from a compound in the bile of cattle. Cortisone is the most complicated substance that manufacturers have been able to make in quantity. EDWARD C. KENDALL

Related Articles in WORLD BOOK include:

ACTH	Hench, Philip S.	Kendall, Edward C.
Gland	Hormone	Reichstein, Tadeus

CORUNDUM, *koh RUN dum* (chemical formula, Al_2O_3), is the second hardest pure mineral. Only diamond is harder. Corundum occurs as transparent nuggets in gravel, and as nontransparent grains in rocks.

Varieties of transparent corundum are polished and used as gemstones. Gemstones from corundum include the ruby, sapphire, Oriental amethyst, Oriental emerald, and Oriental topaz. The colors of the gemstones are caused by impurities in the corundum. For example, the red of the ruby is caused by the presence of chromium oxide, and the blue of the sapphire by iron and titanium. Gemstone corundum comes from Africa, India, the Malagasy Republic, and Russia.

Nontransparent corundum is used as an *abrasive* (grinding, smoothing, and polishing material). Emery, a common abrasive, is a natural mixture of corundum and other minerals. Abrasive quality corundum and emery are mined in Turkey and Greece. WILLIAM C. LUTH

Related Articles in WORLD BOOK include:

Abrasive	Emerald	Gem	Ruby	Topaz
Amethyst	Emery	Hardness	Sapphire	

CORVETTE, *kawr VET,* is a warship about 150 feet (46 meters) long used for convoy duty. It can operate in rough waters for long periods of time. The corvette is larger than a subchaser, but smaller than a frigate or a destroyer. In early sailing days, a corvette was a flush-deck warship, or a vessel whose deckline had not been broken by raised sections. In European navies, it ranked below a frigate in size. It usually had one row of guns. A large American sloop-of-war almost equaled a small corvette in size. WILLIAM W. ROBINSON

CORYMB. See INFLORESCENCE.

CORYPHENE. See DOLPHIN.

CORYZA. See COLD, COMMON.

COSGRAVE, WILLIAM THOMAS (1880-1965), served as president of the Irish Free State's executive council from 1922 to 1932. He lost to Eamon de Valera's party, which wanted complete independence from England. He criticized the 1937 constitution, which established the republic of Eire. But he joined De Valera in supporting President Douglas Hyde's election in 1938.

Born in Dublin, Ireland, Cosgrave went to prison for his part in the 1916 *Easter Rebellion.* Later he served in the revolutionary government from 1919 to 1921. He became president after the head of the Free State, Arthur Griffith, and his successor, Michael Collins, had died in quick succession. ALFRED F. HAVIGHURST

See also DE VALERA, EAMON; IRELAND (The Irish Free State).

COSIMO DE' MEDICI. See MEDICI.

COSINE. See TRIGONOMETRY.

COSMETICS are substances applied to the body to cleanse, to promote attractiveness, or to alter a person's appearance. Cosmetics include deodorants, face powder, lipstick, nail polish, perfume, shampoos, skin creams, and toothpaste. The word *cosmetic* comes from the Greek word *kosmos,* meaning *adornment* or *order.*

Manufacturers use more than 5,000 ingredients in making cosmetics. These ingredients include alcohols, alkalies, dyes, glycerol, oils, talc, and waxes. A person who manufactures or sells cosmetics, or who applies them to others, is called a *cosmetician.* The study of cosmetics and their uses is called *cosmetology.*

Kinds of Cosmetics. Most cosmetics can be classified into four main groups, depending on the part of the body for which they are used: (1) skin, (2) hair, (3) nails, and (4) mouth.

Skin Cosmetics include such makeup as blushers, face powder, foundations, lipstick, and rouge. Eyeliners, eye shadow, and mascara are also skin cosmetics, as are bubble baths, cold cream, deodorants, foot powder, hair-removal substances, perfume, shaving cream, and suntan lotion. Soap is not considered a cosmetic.

Hair Cosmetics include conditioners, permanent waves, shampoos, sprays, and straighteners. Also in this group are hair-coloring products, such as bleaches and dyes.

Nail Cosmetics. Nail polish and cuticle softeners are the chief products in this group, along with creams and lotions that promote the growth of nails.

Mouth Cosmetics include mouthwashes and sprays, and toothpaste and other substances used to clean the teeth.

Other Cosmetics. Actors, such as performers in motion pictures, television, the theater, and circuses, wear special cosmetics. These cosmetics must withstand the heat from powerful lights without melting or running. They also must be visible by the audience. Many people use special medicinal cosmetics to conceal a birthmark, scar, or some other skin blemish.

Cosmetics Regulations. The Food and Drug Administration (FDA), an agency of the federal government, regulates cosmetics in the United States. The FDA requires that cosmetics be safe and properly labeled. It tests cosmetics for unsafe ingredients and inspects cosmetics factories. The agency ruled in 1973 that by 1976, cosmetics manufacturers must list on each package the ingredients used in the product.

The FDA classifies as a cosmetic any product whose sole purpose is to improve a person's appearance. It considers a cosmetic to be a drug if the cosmetic also has the purpose of altering a body function. For example, the FDA regards lipstick as a cosmetic. But it classifies antiperspirants as drugs because manufacturers claim that antiperspirants block the flow of perspiration. The FDA regulates drugs more strictly than cosmetics.

History. Men and women have used cosmetics for thousands of years. The ancient Egyptians applied perfumes and anointing oils to the body as early as 4000 B.C. They used these cosmetics for decoration; for protection against the hot, dry climate; and for religious reasons. The Egyptians, Greeks, and Romans made cosmetics from plants. They also used powdered minerals to make hair dyes and face and eye makeup.

By the A.D. 1100's, the use of cosmetics had spread to Western Europe. People of early African cultures of about the same period painted their bodies for war and for magical ceremonies. In North America, the first cosmetics were the animal fats used by the Indians long before European explorers arrived. The Indians applied these substances as a base for their body paint and for protection from insects and the cold. The Europeans who settled America brought cosmetics with them.

By the early 1900's, most people used only a few basic cosmetics, such as face powder, rouge, and shampoos. The demand for a wider choice of cosmetics grew tremendously after the 1930's, chiefly because of increasingly widespread advertising and promotion of these products. KATHRYN R. COLTON

COSMIC RAYS

COSMIC RAYS are particles of high energy that originate in outer space. Many can penetrate deep into the earth. The rays from radium, nuclear bombs, or X-ray machines can barely penetrate 2 inches (5 centimeters) of lead. The study of cosmic rays sends scientists to all parts of the earth. They climb to the tops of high mountains, descend into the deepest mines, and drift far above the earth in balloons to learn about this radiation. Instruments that study cosmic rays have been sent far out into space in rockets and satellites. The study of cosmic rays was one of the most important parts of the International Geophysical Year (see INTERNATIONAL GEOPHYSICAL YEAR).

What Cosmic Rays Are

The rays detected in deep mines, at the surface of the earth, and even on high mountains are *secondary* cosmic rays. The *primaries* come from outside the earth's atmosphere. They crash into the nuclei of atoms of the air, and create a variety of secondary particles. Some of these, in turn, produce still more particles. Most primary particles lose their identity in the part of the atmosphere more than 10 miles (16 kilometers) above the earth.

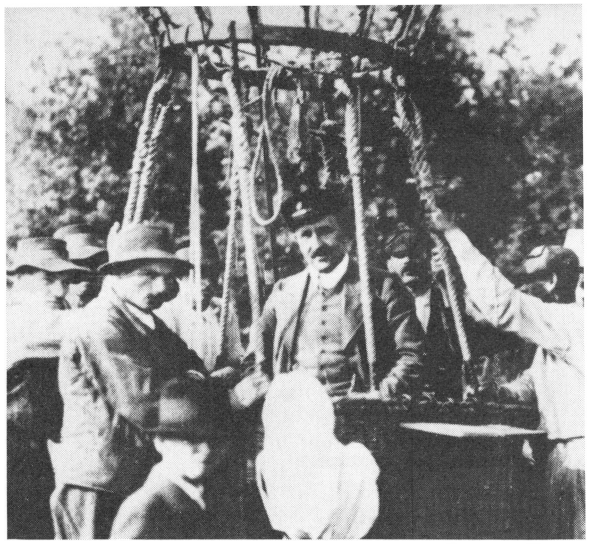
The Secondaries are composed of all the known subatomic particles, including mu-mesons, pi-mesons, neutrons, electrons, and positrons (see ATOM [Inside the Atom]). High-energy X rays, or gamma rays, are also present. At sea level, about 10 secondaries pass through 1 square inch (6.5 square centimeters) of the surface of the earth every minute. The intensity increases up to several hundred secondaries in 1 square inch each minute about 10 miles (16 kilometers) above the earth.

The Primaries are atomic nuclei with energies from a few hundred million to about 1,000,000,000,000,000,000 ev, or electron volts (see NUCLEAR ENERGY [table]). The largest particle accelerators achieve energies near 30,000,000,000 ev. About 87 per cent of the primaries are *protons* (nuclei of hydrogen atoms). About 12 per cent are helium nuclei. The rest are nuclei of heavier elements.

Variations in Intensity. Between 50 and 200 primary cosmic rays pass through an area of 1 square inch (6.5 square centimeters) each minute. This range in intensities results partly from a *latitude effect*. Primary cosmic rays bear electric charges, so the earth's magnetic field deflects them. The particles have a wide range of energies. Near the equator, only high-energy particles can penetrate the magnetic field. But at the poles, particles of lower energies can penetrate. The intensity of radiation is lowest near the equator and increases toward the poles. At the equator, the primary cosmic-ray intensity is only a third to a fourth of its value at the poles. Usually, a "cut-off" latitude exists, beyond which intensity of cosmic radiation does not increase toward the poles. This occurs because no particles have energies lower than that needed to penetrate the earth's field at the cut-off latitude. The cut-off energy varies.

How the Sun Affects Cosmic Radiation

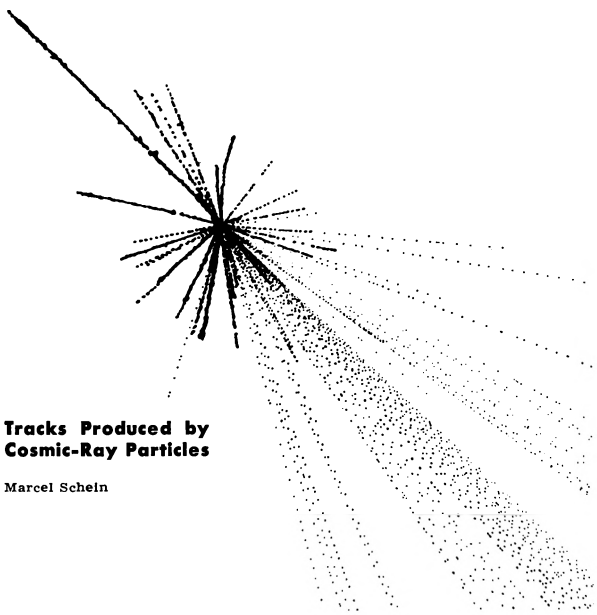
When eruptions on the sun occur most frequently, the cosmic-ray intensity is usually less than when the sun is not active. For example, 1957 was a year of great solar activity. In that year, the total cosmic-ray intensity was about a third of the total cosmic-ray intensity in 1954, a year of little solar activity. The sun has an 11-year cycle of activity, and so do cosmic rays (see SUN [Sunspots]). Effects of shorter duration also exist. For example, the intensity may drop sharply in a few hours and build up slowly over a period of days. Scientists believe that both the 11-year cycle and the short-term effects result from variations in solar activity. But a different mechanism causes each. Physicists do not understand in detail the ways that solar activity influences cosmic rays. They believe that material ejected from the sun produces these effects. Short-term effects probably occur when this material interacts with the magnetic field of the earth. The 11-year cycle is probably caused by larger-scale events explained later in this article.



Fordham University

The Beginning of High-Altitude Cosmic-Ray Research took place in the early 1900's when Victor F. Hess of Austria made several balloon flights to measure the intensity of the rays.

Cosmic Rays from the Sun. Large increases in cosmic-ray intensity sometimes accompany giant explosions, or solar flares, on the sun. The solar flare of Feb. 23, 1956, increased cosmic-ray intensity about 50 times the normal at some places. Particles came from the sun a few minutes after the flare was seen. They had energies up to at least 30,000,000,000 ev. The intensity remained above normal many hours after the flare ceased.



Tracks Produced by Cosmic-Ray Particles

Marcel Scheln

Solar System Barrier. Physicists believe that a barrier exists in the solar system beyond the orbit of the earth. Some cosmic rays pass through this barrier. But it reflects others. This takes place in much the same manner as light from a city is reflected by clouds above it. If the barrier did not exist, cosmic-ray intensity would return to normal shortly after the flare ceased. The particles would escape directly into the galaxy. The barrier causes them to be scattered back and forth in the inner part of the solar system before they escape.

This same barrier should also affect cosmic rays traveling towards the solar system from the rest of the galaxy. It probably contains magnetic fields that deflect and reflect particles. Physicists believe that material ejected from the sun produces the barrier. The quantity of material ejected depends on the sun's activity. The barrier is stronger at times of increased solar activity, and lets fewer cosmic rays through. Changes in strength of the barrier probably produce the 11-year cycle of intensity and the variations in cut-off energy.

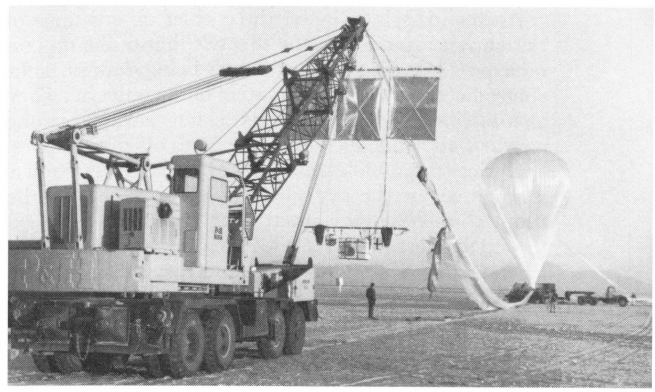
Energies of Cosmic Rays

Physicists believe that a magnetic field extending throughout the galaxy affects the paths of the cosmic rays. Particles spend about 10,000,000 years wandering in the galaxy before escaping from this field. The cosmic rays are probably accelerated to their high energies during the time they spend in the field.

Acceleration probably occurs when the particles "collide" with moving irregularities in the magnetic field. When a particle collides head on with a moving object it gains energy. For example, in table tennis, a moving ball gains speed after it strikes a paddle moving towards it. But, if the ball strikes a paddle moving away from it, the ball loses speed. The ball corresponds to a cosmic-ray particle and the paddle to a moving irregularity in the magnetic field of the galaxy. You might think that because a particle gains energy in one kind of collision and loses it in another, there would be no over-all gain or loss of energy. But a moving particle makes more head-on collisions with moving objects than overtaking collisions. Scientists believe that equal numbers of magnetic irregularities move in opposite directions through any region of the galaxy, like automobiles on a highway. A cosmic ray encounters more irregularities head-on than it overtakes, the same way that a motorist on a highway sees more cars coming toward him than in the direction he goes. Thus, over a long period of time, cosmic rays are slowly accelerated.

Effects of Cosmic Rays

Cosmic radiation affects both individuals and the human race as a whole. A human being can probably tolerate a radiation dose of $\frac{1}{100}$ roentgen, the unit of radiation, each day without damage to his body. The dosage from cosmic rays at sea level amounts to about $\frac{1}{1,000}$ roentgen each day. Even at the highest altitudes at which man lives, the dosage remains well below the danger level. However, at extremely high altitudes, or beyond the atmosphere, the dosage probably exceeds the amount that man can tolerate. The heavy nuclei in the primaries, although of low intensity, may produce serious biological effects. This represents a hazard for space travelers (see RADIATION SICKNESS; SPACE TRAVEL [Dangers in Space]).



U.S. Air Force

Modern Cosmic-Ray Research uses unmanned balloons. The balloon shown above carried large plastic panels that recorded cosmic-ray particles passing through them at high altitudes.

The effects of cosmic rays on man come about through *mutation*, or changes in heredity. Heat and chemicals cause about 90 per cent of all mutations (see MUTATION). Radiation causes the rest. Of this fraction, cosmic rays cause about a fourth.

History

Scientists discovered cosmic rays in the early 1900's. At that time, the electroscope was commonly used for observing radioactivity (see ELECTROSCOPE). This instrument discharges in the presence of radioactivity. Scientists found that even when they shielded an electroscope with lead from all known radioactive materials, it continued to discharge. At first, they thought that traces of radioactivity on the earth caused the leakage of radiation into the electroscope. But when electroscopes were flown in balloons to escape such effects, scientists found that the rate of leakage increased up to the highest altitudes reached at that time, 30,000 feet (9,100 meters). This indicated that rays from the atmosphere or beyond caused the leakage.

In the late 1920's, scientists found that the intensity of cosmic rays varies with latitude. This indicated that primary cosmic rays are electrically charged particles. New instruments showed that the secondaries are charged particles and gamma rays. In the 1930's, physicists discovered new subatomic particles, the positron and mu-meson, in secondary cosmic rays (see MESON). In the late 1940's, they discovered more types of secondary particles. Special photographic films carried to high altitudes by balloons showed that primaries consist of protons and the nuclei of heavier elements. In the 1950's, research centered on the effects of the sun on cosmic rays.

K. B. FENTON

Related Articles in WORLD BOOK include:

Atom	Geiger Counter	Radioactivity
(Inside the Atom)	Ion Counter	Wilson Cloud
Delta Ray	Radiation	Chamber

COSMOLOGY. See METAPHYSICS (Branches).

COSMOLOGY, in astronomy, is the study of the structure and history of the universe. It tries to explain how the universe was formed, what happened to it in the past, and what might happen to it in the future.

Astronomers interpreted three chief observations of the universe to develop the theories that make up cosmology. They noted that the sky's being dark at night contradicted a simple explanation of the universe. They also observed that distant galaxies move away from one another, and that the entire sky gives off radio waves.

During the 1700's and 1800's, several astronomers thought about the sky's being dark at night. In the simplest universe they could imagine, the universe extended forever with stars distributed evenly throughout it. But in such a universe, a person would be able to look anywhere in the sky, and his line of sight would eventually reach a star. The entire night sky would therefore appear to be a solid mass of stars as bright as the sun. But the sky is dark—and so the universe must have a more complex structure.

In the early 1900's, astronomers observed that the light from stars in distant galaxies appeared redder than they expected. This phenomenon is called *red shift* (see RED SHIFT). It results from the rapid motion of the galaxies. Astronomers can calculate the speed of a galaxy from its red shift. By studying the speed of the galaxies' motion at various distances from the earth, they found that all galaxies came from one point in space about 13 billion years ago.

In 1965, radio astronomers detected faint radio waves regardless of where they pointed their radio telescope. This observation showed that the entire universe is a source of weak radio waves.

The Big Bang Theory provides the best explanation of the three basic cosmological observations. According to this theory, the universe began as the result of an explosion—called the big bang—about 13 billion years ago. Immediately after the explosion, the universe consisted chiefly of strong radiation. This radiation formed a rapidly expanding sphere called the *primordial fireball.*

After a few hundred years, most of the fireball changed into matter that consisted chiefly of hydrogen. It also included a small amount of helium and other elements. Today, faint radio waves are all that remain of the original fireball. Like the fireball, the matter continued to move away from the point of the explosion. In time, the matter broke apart in huge clumps. The clumps became galaxies. Smaller clumps within the galaxies formed stars. Part of at least one clump became a group of planets—the solar system.

The galaxies are still moving away from one another. But some astronomers believe all the galaxies will come together again in about 70 billion years. If this happens, all the material in the universe will explode again and become a new universe resembling the present one. Such a "recycling" of the universe may have happened many times in the past and may go on forever.

The Steady State Theory offers another explanation of the cosmological observations. According to this theory, the universe has always existed in its present state. As the galaxies move apart, new matter appears between them and forms new galaxies. The theory does not say where this matter comes from. Few astronomers today accept the steady state theory. FRANK D. DRAKE

See also UNIVERSE (Cosmological Theories).

COSMONAUT. See ASTRONAUT.

J. Horace McFarland

Cosmos Flowers have white, pink, crimson, or orange petals with a bright yellow center. The leaves are delicate and feathery.

COSMOS, *KAHZ muhs*, are tall, late-summer flowers that are native to Mexico and the American tropics. Their flowers range from white and pink to red and orange, and may be double or single. Cosmos are in the daisy family.

Seeds may be planted outdoors after the ground warms, or indoors in early spring and then transplanted a few weeks before summer. Cosmos are well adapted to full sun, and to light soil that is not too rich. Most varieties need protection from wind because they are so tall. They make good background plants or fillers among shrubs. They also provide excellent cut flowers.

Scientific Classification. Cosmos belong to the composite family, *Compositae*. They make up the genus *Cosmos*. The familiar garden plants are *C. bipinnatus*, the yellow cosmos is *C. sulphureus*. ROBERT W. SCHERY

See also COMPOSITE FAMILY; FLOWER (color picture: Fall Garden Flowers).

COSMOS is a term used to refer to everything in creation, from the smallest atoms to the most distant celestial bodies. The ancient Greeks originated the term. To them, the cosmos was a well-ordered, harmonious system. The earth, the sun, and the planets made up their cosmos.

Today, we know that the sun is only one of about 100 billion stars that form the Milky Way. This galaxy is one of at least 100 billion galaxies that make up the observable universe. I. M. LEVITT

See also GALAXY; UNIVERSE.

COSMOTRON, *KAHZ moh trahn*, is the name scientists have given to a high-energy atom smasher, or *nuclear accelerator*, built at the Brookhaven National Laboratory on Long Island, New York. It has a huge circular magnet weighing 2,200 short tons (2,000 metric tons). Sandwiched inside the magnet is a vacuum chamber 60 feet (18 meters) in diameter. Protons produced in a Van de Graaff generator are injected into the cos-

motron vacuum chamber at 5 million electron volts (5 mev) of energy. These charged particles are accelerated again and again as they speed around the 60-foot (18-meter) orbit, until they finally reach over 2 billion electron volts (2 bev). Then, the protons have energies about equal to those which are found in cosmic rays. Hence the name *cosmotron*. An even higher energy machine called a *bevatron*, at the University of California, works on the same principle. RALPH E. LAPP

See also PARTICLE ACCELERATOR with its *Related Articles*.

COSPAR. See SPACE TRAVEL (Steps in the Conquest of Space).

COSSACK, *KAHS ack*, is the name given to a group of about 3 million Russians living in southern and eastern parts of Russia. They are Slavic peoples who became border defenders against the Tartars in the 1400's (see SLAV). They gained a reputation as daring horsemen and mercenary soldiers who recognized no authority but their own. The name *Cossack* comes from a Tartar word meaning *free laborer*. Eleven groups of Cossacks developed. The Don and Kuban Cossacks were the largest of these groups.

Cossacks were an elite corps in the armies of the czars and received special privileges, including exemption from taxes. After the Revolution, they fought on the side of the White armies, trying to overthrow the new government. Their historical organization was broken up after the Red, or Bolshevik, armies won the civil war. Many were killed or deported.

Cossack cavalry units served effectively against German tanks in World War II. WILTON MARION KROGMAN

See also COSSACKS, DON.

COSSACK ASPARAGUS. See CATTAIL.

COSSACKS, DON, were one of the largest and most powerful groups of Cossacks in southern Russia before the Russian Revolution. When the Bolsheviks, or Reds, took over the government, the Don Cossacks joined the forces opposing them, called the *Whites*. The Whites lost the civil war that followed, and many fled or were deported. One enterprising leader, Serge Jaroff, formed a group to sing Russian folk songs and liturgical music. His *Don Cossack Chorus* won wide acclaim in tours through Europe, and finally settled in the United States. Their performances, which feature strong rhythms and good control of dynamics, brought Russian folk music to many who had never heard it before. See also SHOLOKHOV, MIKHAIL A.

COST. See PRICE.

COST OF LIVING is the amount of money needed to buy a standard amount of goods and services of daily living. Needs of individual persons and families vary. Everyone needs food, clothing, and shelter, but needs go beyond these bare necessities. The cost of living includes the cost of transportation, reading, recreation, rent, electricity, gas, fuel, home furnishings, medical and personal care, taxes, and many other things.

When salaries and wages keep step with the prices of goods and services, the worker's buying power remains stable. When prices rise, persons with low incomes or fixed incomes, such as pensions, fall behind in buying power. Increases and decreases in the cost of living come from many things. Rising incomes, spending, abundance of credit, industrial expansion, and cost of new equipment tend to make prices go up. When more goods than money are available, prices go down.

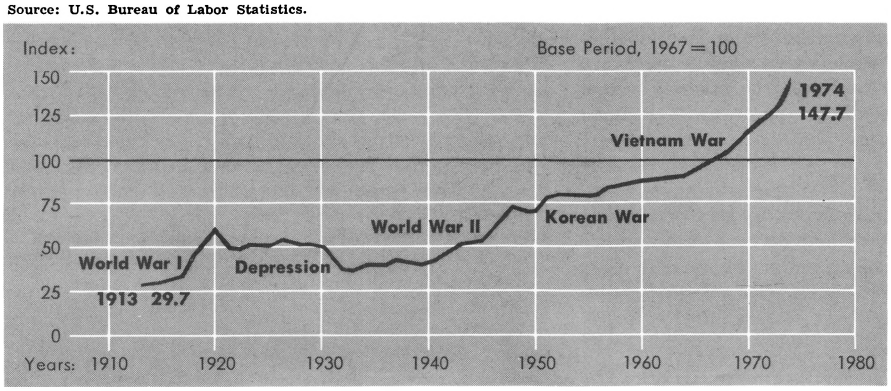
The Bureau of Labor Statistics is the fact-finding agency of the United States government in the field of labor economics. It collects and analyzes data on employment, wages, and productivity. The bureau also collects data throughout the United States to measure changes in the prices of consumer goods and services, and reports its findings through its publications. It publishes a Consumer Price Index that summarizes this information. In preparing the index, the bureau regularly collects information on food prices from about 1,700 food stores, on rent from about 40,000 tenants, and on all other goods and services from about 16,000 other establishments. In addition to the index for the entire country, the Bureau of Labor Statistics publishes separate consumer price indexes for 23 metropolitan areas. KENNETH E. BOULDING

See also INFLATION AND DEFLATION; WAGES AND HOURS.

COST OF LIVING IN THE UNITED STATES

The Consumer Price Index, prepared by the U.S. Bureau of Labor Statistics, measures the cost of living in the United States. The index shows changes in prices of goods and services purchased by city families and single persons. The bureau collects prices for about 400 items in 56 urban areas. In 1971, the bureau changed the reference base period from 1957-1959 to 1967.

Source: U.S. Bureau of Labor Statistics.



Year	Index
1915	30.4
1920	60.0
1925	52.5
1930	50.0
1935	41.1
1940	42.0
1945	53.9
1950	72.1
1955	80.2
1960	88.7
1965	94.5
1970	116.3
1971	121.3
1972	125.3
1973	133.1
1974	147.7

Björn Klingwall from Carl Östman

San José, Costa Rica's Capital and Largest City, lies in a valley in the mountainous interior. Modern stores and office buildings stand among Spanish-style churches and small houses.

COSTA RICA

COSTA RICA is a small, mountainous country in Central America. It ranks fifth among the six Central American republics in both area and population. Costa Rica is a little smaller than West Virginia and has about as many people as that state. The country is bordered by Nicaragua on the north, the Caribbean Sea and Panama on the east, and the Pacific Ocean on the south and west. A chain of rugged mountains stretches across central Costa Rica from northwest to southeast. A few of the highest peaks are active volcanoes. Tropical forests grow on the coastal lowlands.

Spanish explorers arrived in what is now Costa Rica in the early 1500's. The Indians who lived there told them stories about deposits of gold and other precious metals supposedly mined in the region. The Spaniards named the land *Costa Rica*, which means *rich coast*. But they found that the area has little mineral wealth.

Today, almost all Costa Ricans are of mixed Spanish and Indian ancestry. Nearly 70 per cent of the people live on a fertile plateau in the mountains of central Costa Rica. San José, the capital and largest city, lies in this region. Hillsides covered with coffee trees surround San José. Coffee ranks as the country's chief export. Bananas, another major export, grow on large plantations near the coasts.

Government

Costa Rica is a democratic republic. Its Constitution was adopted in 1949. A president serves as the nation's chief executive and head of state. The people elect him to a four-year term. He and the members of his Cabinet make up the Council of Government. The council conducts foreign affairs and enforces federal laws. It may also *veto* (reject) bills passed by the Legislative Assembly, Costa Rica's one-house legislature.

The Legislative Assembly has 57 deputies, who are elected by the people to a four-year term. Neither the president nor the deputies may be elected to two terms in a row. The Supreme Court of Justice, the nation's highest court, has 17 justices appointed by the legislature to renewable eight-year terms. The Constitution abolished the army, but military forces may be organized for national defense.

Nathan A. Haverstock, the contributor of this article, is the director of The Latin American Service in Washington, D.C., and the author of The Organization of American States: The Challenge of the Americas.

FACTS IN BRIEF

Capital: San José.

Official Language: Spanish.

Official Name: República de Costa Rica (Republic of Costa Rica).

Form of Government: Republic. *Head of State*—President.

Area: 19,575 sq. mi. (50,700 km²). *Greatest Distances*—north-south, 220 mi. (354 km); east-west, 237 mi. (381 km). *Coastline*—380 mi. (612 km) on the Pacific; 133 mi. (214 km) on the Caribbean.

Elevation: *Highest*—Chirripó Grande, 12,530 ft. (3,819 m) above sea level. *Lowest*—sea level along the coasts.

Population: *Estimated 1976 Population*—2,089,000; distribution, 62 per cent rural, 38 per cent urban; density, 106 persons per sq. mi. (41 per km²). *1973 Census*—1,871,780. *Estimated 1981 Population*—2,446,000.

Chief Products: *Agriculture*—bananas, cacao, cattle, coffee, corn, sugar cane. *Manufacturing*—furniture, leather goods, processed foods, textiles.

National Anthem: "Himno Nacional" ("National Hymn").

Money: *Basic Unit*—colón. See MONEY (table); COLÓN.

Costa Rica has seven provinces. The provinces are divided into 69 *cantons* (counties). Each province has a governor appointed by the president. An elected council governs each canton. The cantons provide fire protection, sanitation, water, and other local services.

All citizens 18 years or older may vote in national elections. The country has two major political parties, the liberal National Liberation Party and the more conservative National Unification Party.

People

Population and Ancestry. In 1976, the population of Costa Rica totaled about 2,089,000 and was increasing at a rate of more than 3 per cent a year. If this rate continues, the population will double every 22 years.

Many Spanish colonists who settled in Costa Rica in the 1500's and 1600's married native Indians. Their descendants are called *mestizos*. Today, mestizos and whites of unmixed ancestry make up more than 97 per cent of the population. Costa Rica also has two small minority groups—about 35,000 Negroes and about 5,000 Indians. The Negroes live along the Caribbean coast. Their ancestors came to Costa Rica from the island of Jamaica in the late 1800's to build railroads and to work on the banana plantations. The Indians live in isolated communities in the highlands and along the Caribbean and Pacific shores. They keep their tribes' traditional ways of life.

Costa Ricans take great pride in their country's heritage of democratic government and social equality. They also value their own personal dignity and strong family ties. Nearly all Costa Ricans speak Spanish, but many Negroes still speak a Jamaican *dialect* (local form) of English. About 90 per cent of the people belong to the Roman Catholic Church.

Housing. Nearly two-thirds of all Costa Ricans live on farms or in rural towns. Many farmers live in adobe cottages with thick, white stucco walls and red- or pink-tiled roofs. Other farmers live in brightly painted wooden houses. They nail tin cans filled with flowers and plants to the outside walls for decoration. Most city people live in apartment buildings or in *row houses*. Such houses look much alike and are attached to one another in a row. Wealthy families own spacious ranch-style or Spanish-style homes surrounded by gardens.

WORLD BOOK map

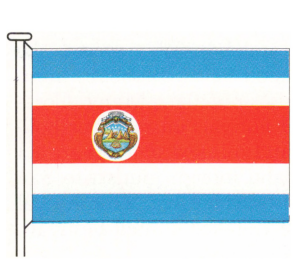
Costa Rica is a Central American country that lies between the Caribbean Sea and the North Pacific Ocean.

R. Lyon, Alpha Photo Assoc.

An Open-Air Market in Cartago is jammed on Sundays with shoppers who buy produce from local farmers. The woman seated in the foreground is selling tickets for Costa Rica's National Lottery.

Food. The diet of most Costa Ricans includes beans, coffee, corn, eggs, rice, and such tropical fruits as bananas, guavas, mangoes, and pineapples. Many families serve meat at the evening meal. They often prepare *tamales* (ground pork and corn meal steamed in corn husks) and *tortillas* (thin corn-meal pancakes). Such foods as boiled iguana eggs and cooked hog's head are special treats served on festive occasions.

Education. About 90 per cent of Costa Rica's people can read and write, a higher percentage than in any other Central American country. Costa Rican law requires all children to complete elementary school. But some students drop out because they must work to help support their families. Students who graduate may attend secondary school and then enter a university. The country has two universities, the National University in Heredia and the University of Costa Rica near San José.



Costa Rica's State Flag, used by the government, was adopted in 1848. The national flag has no coat of arms.

The Coat of Arms shows three volcanoes, the Caribbean Sea, and the Pacific Ocean. Each star represents a province.

COSTA RICA

Provinces*

Alajuela	326,032	A 3
Cartago	204,699	B 4
Guanacaste	178,691	B 1
Heredia	133,844	B 3
Limón	115,143	B 4
Puntarenas	218,208	D 4
San José	695,163	B 3

Cities and Towns

Aguas Claras	2,713▲	A 2
Aguas Zarcas	4,095▲	B 3
Alajuela	30,190	B 3
Alajuelita*	6,673	B 3
Bagaces	2,129	A 2
Buenos Aires	302	C 4
Calle Blancos*	12,408	B 3
Cañas	6,053	B 2
Carmen*	6,151	B 4
Carmona	824	B 2
Cartago	21,753	B 4
Cinco Esquinas*	13,385	B 3
Ciudad Quesada	9,754	B 3
Corredor	14,452▲	D 5
Curridabat*	7,605	B 3
Desamparados*	30,659	B 3
Escazú*	9,294	B 3
Esparta	4,699	B 3
Filadelfia	2,958	B 2
Golfito	6,962	D 4
Grecia	8,355	B 3
Guadalupe	27,016	B 3
Guápiles	3,524	B 4
Heredia	22,700	B 3
La Cruz	1,723▲	A 2
La Cuesta	5,195▲	D 5
La Fortuna	3,710▲	B 3
Las Juntas	1,129	B 2
Lepanto	9,928▲	B 2
Liberia	10,802	A 2
Limón	29,621	B 5
Los Chiles	3,190▲	A 3
Matina	502	B 4
Miramar	1,673	B 3
Naranjo*	5,944	B 3
Nicoya	7,474	B 2
Orotina	3,170	B 3
Palmar Sur	13,660▲	C 4
Paquera	4,947▲	B 2
Paraíso	8,446	B 4
Parrita	1,365	C 3
Puerto Cortés	2,070	C 4
Puerto Jiménez	2,231▲	D 4
Puntarenas	26,331	B 2
Quepos	2,155	C 3
Roxana	4,345▲	B 4
Sabalito	5,802▲	C 5
Sámara	2,317▲	B 2
San Antonio*	4,810	B 3
San Ignacio	446	B 3
San Isidro	8,871	C 4
San Isidro*	4,737	B 3
San José	215,441	
	*438,658	B 3
San Juan*	18,670	B 3
San Nicolas*	6,693	B 4
San Pedro*	23,721	B 3
San Rafael*	6,967	B 4
San Rafael*	4,720	B 3
San Rafael	2,810▲	A 2
San Ramón	9,245	B 3
San Vicente*	14,381	B 3
Santa Cruz	5,777	B 2
Santa Cruz	2,492▲	B 4
Santiago	2,588	B 3
Santo Domingo*	5,148	B 3
Savegre	3,419▲	C 3
Siquirres	4,361	B 4
Tilarán	3,294	B 2
Tres Ríos*	6,082	B 3
Turrialba	12,151	B 4
Upala	5,492▲	A 2
Veintisiete de Abril	10,274▲	B 1
Volcán	3,589▲	C 4
Zarcero*	1,234	B 3

*Does not appear on the map; key shows general location.
*Population of metropolitan area, including suburbs.

Source: 1973 census. Figures are for urban parts of districts, except for those marked with a triangle (▲), which are for entirely rural districts.

Recreation. Costa Ricans enjoy spending their leisure time outdoors. Many men and boys play soccer, the national sport, in neighborhood fields. Baseball, hunting, and swimming are also popular. Many Costa Ricans take part in colorful festivals on religious holidays. Bullfights, fireworks, and masked parades attract thousands of Costa Ricans and foreign tourists to San José during the annual Christmas festival. This festival is called *El Tope Fiesta* (The Get-Acquainted Festival).

The Land and Climate

A chain of high mountain ranges, which are called *cordilleras*, crosses central Costa Rica from northwest to southeast. The cordilleras divide the country into three land regions: (1) the Central Highlands; (2) the Caribbean Lowlands; and (3) the Pacific Coastal Strip.

The Central Highlands consist of two large areas of fertile farmland—the *Meseta Central* (Central Plateau) and the *Valle del General* (Valley of the General). The steep cordilleras surround each area. The Meseta Central is the heartland of Costa Rica. Almost 70 per cent of the nation's people live there. The Meseta's rich volcanic soil and favorable climate also make it the country's chief coffee-growing region. Daytime temperatures range from 75° to 80° F. (24° to 27° C) the year around. The area receives about 70 inches (180 centimeters) of rainfall a year. The Valle del General lies to the southeast. It is an agricultural region of hills and plains. Day-

time temperatures range from 80° to 90° F. (27° to 32° C). Yearly rainfall averages about 110 inches (279 centimeters).

The Caribbean Lowlands, a wide band of swampy tropical jungles, lie along the east coast. The daytime high temperature averages about 100° F. (38° C). Yearly rainfall ranges from 150 to 200 inches (381 to 510 centimeters).

The Pacific Coastal Strip is largely an area of lowlands along the west coast. Low mountains rise along most of the shore. This region has an ideal climate for growing bananas. Daytime temperatures range from 77° to 100° F. (25° to 38° C). The annual rainfall totals about 130 inches (330 centimeters).

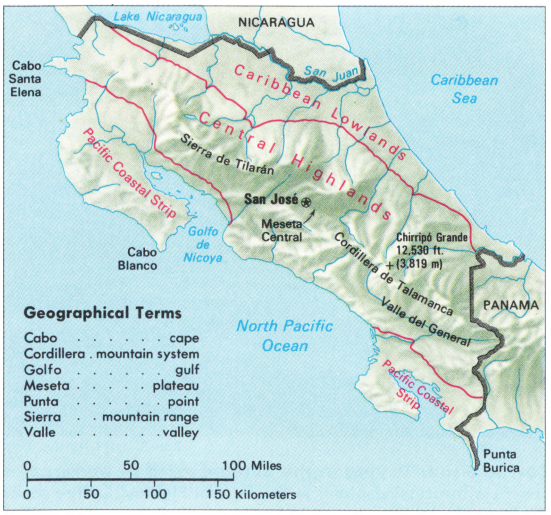
Economy

Costa Rica has one of the fastest-growing economies in Latin America. The nation's chief natural resource is its fertile volcanic soil. Forests of cedar, laurel, mahogany, oak, and pine trees cover about two-thirds of the land. The country also has small deposits of bauxite, gold, and manganese.

About half of Costa Rica's workers are engaged in farming or ranching. Bananas, cacao, coffee, corn, meat, and sugar rank as the chief agricultural products. Manufacturing employs about 10 per cent of the labor force and is growing rapidly. The leading manufactured products include furniture, leather goods, processed foods, and textiles.

Costa Rica's prosperity relies heavily on foreign trade. Its leading exports include bananas, coffee, meat, and sugar. The chief imports include crude oil and manufactured goods. The United States is Costa Rica's chief trading partner. Other partners include Great Britain, Japan, and West Germany. Costa Rica belongs to the Central American Common Market, an economic union formed to stimulate trade among its members.

In the mid-1970's, a high rate of inflation and the worldwide energy shortage threatened to slow down



WORLD BOOK map

Costa Rica has three land regions. Most of the people live in the Central Highlands, where the temperatures are more comfortable than in the Caribbean Lowlands and the Pacific Coastal Strip.

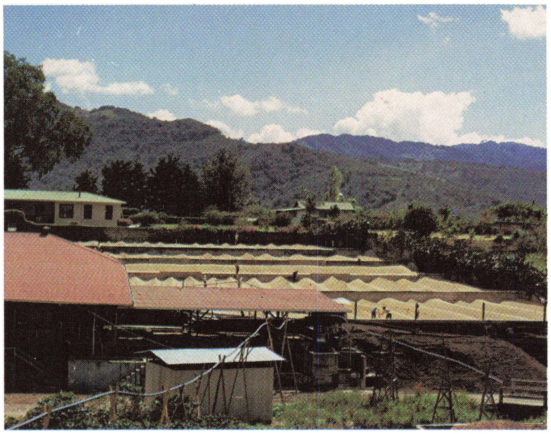
Costa Rica's economic growth. But agricultural and industrial production have continued to rise steadily. To meet the nation's increasing energy needs, the government plans to build more hydroelectric plants.

About 13,000 miles (20,900 kilometers) of roads span Costa Rica. The Pan American Highway links all the provincial capitals except Limón and Puntarenas (see PAN AMERICAN HIGHWAY). The country has about 500 miles (800 kilometers) of railway. Railroads link San José to the port cities of Limón and Puntarenas. Costa Rican Airlines has flights from San José to other Central American cities and to Mexico and the United States.

Costa Rica has about 55 radio stations and 11 tele-

Reinhold A. Eckelhoefer

The Central Plateau is the agricultural heartland of Costa Rica. Coffee, corn, rice, and sugar grow on the rolling hillsides. The city of San José lies in the distance.



Ann Hagen Griffiths, DPI

Coffee Beans Drying in the Sun are raked by workers at a *beneficio* (processing plant) in the Central Plateau. Coffee ranks as Costa Rica's chief export.

vision stations. The country's eight daily newspapers are all published in San José.

History

Indians were the first people to live in what is now Costa Rica. By 1000, the Corobicí tribe had settled in the northern valleys, and the Boruca had migrated to lands in the south. The Carib, Chorotega, and Nahau Indians arrived in the 1400's. Most of the Indians raised crops near their villages and hunted small game.

Colonial Period. Christopher Columbus arrived in Costa Rica in 1502. Rumors of gold deposits in the area soon lured hundreds of Spaniards to the new land. The Spaniards found little mineral wealth. But many of them stayed to become farmers in the Central Highlands. Governor Juan Vásquez de Coronado founded the first permanent settlement at Cartago in 1564. Many Spaniards tried to enslave the Indians, but most of the tribes fought fiercely to stay free.

Independence. Costa Rica remained a Spanish colony until 1821. That year, Costa Rica and Spain's other Central American colonies broke away from Spanish rule. They joined the Mexican Empire the next year. In 1823, the Central American states withdrew from Mexico and formed the United Provinces of Central America. The union began to collapse in 1838, and Costa Rica declared its independence.

In 1842, Francisco Morazán overthrew the dictatorship of President Braulio Carrillo and became president. Morazán attempted to revive the union, but his enemies killed him five months after he took office. Weak leaders governed the country until 1849, when Juan Rafael Mora began a 10-year term as president. Mora established Costa Rica's first national bank, its first street-lighting system, and many public schools.

Revolutions and Reforms. Since the late 1800's, Costa Rica has had several revolutions. General Tomás Guardia overthrew the government in 1870 and ruled as a dictator for 12 years. He encouraged large-scale cultivation and heavy exports of coffee. His government improved the public school system and built a railroad from San José to Limón. In 1917, Federico Tinoco seized the presidency. Political turmoil forced him to resign in 1919, and Julio Acosta became the new leader. Under Acosta and his successors, Costa Rica became a model of democracy and social reform.

In 1948, Otilio Ulate won the presidential election, but the National Assembly declared the results illegal. Colonel José Figueres then led a revolt in support of Ulate. Figueres took over the presidency, reorganized the government, and placed the banks under federal control. Ulate was inaugurated as president in 1949.

Costa Ricans elected Figueres to the presidency in 1953. He raised the minimum wage, expanded the public school system, and increased the tax on imports. In 1955, a band of exiled Costa Ricans staged an air and land invasion of the country from Nicaragua. The revolutionaries tried to overthrow the Figueres government, but were quickly defeated. President Mario Echandi, who served from 1958 to 1962, tried to reduce the government's control over the economy. But the Legislative Assembly blocked many of his proposals. Francisco J. Orlich was elected president in 1962.

From 1963 to 1965, the volcano Irazú showered tons of ash over San José and the surrounding countryside. The eruptions damaged the coffee crop and forced thousands of persons to abandon their homes.

Recent Developments. Figueres won the presidency again in 1970. He succeeded José Joaquín Trejos-Fernández. In 1974, many Costa Ricans criticized Figueres for refusing to deport Robert Vesco, a United States businessman who had fled to Costa Rica. Vesco was accused of plotting to steal $224 million from an investment company he controlled. He invested at least $60 million of his personal fortune in Costa Rican businesses and public housing projects. Daniel Oduber was elected president in 1974. He pledged to continue Figueres' social reforms and to make government services more efficient.

NATHAN A. HAVERSTOCK

Related Articles in WORLD BOOK include:
Alajuela
Banana (graph)
Central America
Central America, United Provinces of
Latin America
Mora, Juan Rafael
Morazán, Francisco
Puntarenas
San José

Outline

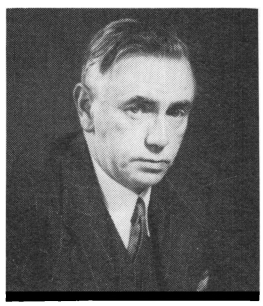
I. Government
II. People
A. Population and Ancestry
B. Housing
C. Food
D. Education
E. Recreation
III. The Land and Climate
A. The Central Highlands
B. The Caribbean Lowlands
C. The Pacific Coastal Strip
IV. Economy
V. History

Questions

How did Costa Rica get its name?
What percentage of Costa Rica's people can read and write?
What is the national sport of Costa Rica?
How fast is Costa Rica's population growing?
What is *El Tope Fiesta?*
What are the *cordilleras?*
In which land region do most Costa Ricans live?
What are Costa Rica's leading exports?
What is Costa Rica's chief natural resource?
What were some of José Figueres' accomplishments as president?

COSTAIN, THOMAS BERTRAM (1885-1965), a Canadian-American novelist and historian, began writing books at the age of 54. He produced many widely read historical novels. His novels include *For My Great Folly* (1942), *The Black Rose* (1945), *The Moneyman* (1947), *High Towers* (1949), *The Silver Chalice* (1952), and *The Tontine* (1957). *The White and the Gold* (1954) is a history of Canada to 1763. *The Last Plantagenets* (1962) completed a four-volume history series called "The Pageant of England." Born in Brantford, Ont., Costain worked as a newspaper and magazine editor before becoming an author. HARRY R. WARFEL

COSTELLO, *KAHS tuh lo,* **JOHN ALOYSIUS** (1891-), served as Prime Minister of the Republic of Ireland from 1948 to 1951 and from 1954 to 1957. In 1948 he headed a party coalition that took the leadership Eamon De Valera had held for 16 years. De Valera held political control between Costello's two terms, and, in 1957, his victory ended Costello's second term. Costello was born in Dublin and received a law degree. He served as Attorney General of the Irish Free State from 1926 to 1932. ALFRED F. HAVIGHURST



Consulate General of Ireland
John A. Costello

See also DE VALERA, EAMON; IRELAND (The Republic of Ireland).

COSTUME. See CLOTHING; THEATER (Costumes); BALLET (Costumes).

CÔTE D'AZUR, *KOHT DAH ZYUR,* is the eastern end of the Mediterranean Coast of France. This area includes part of the French Riviera, a famous vacation resort (see RIVIERA). The name *Côte d'Azur,* meaning *azure coast,* was given to this region because of the beautiful deep blue of the sea and the sky. Groves of palm and orange trees and gardens of brilliant tropical flowers line the shore. This part of the Mediterranean Coast is a health resort area and playground for travelers from all parts of the world. W. R. MCCONNELL

COTEAU. See SOUTH DAKOTA (Land Regions).

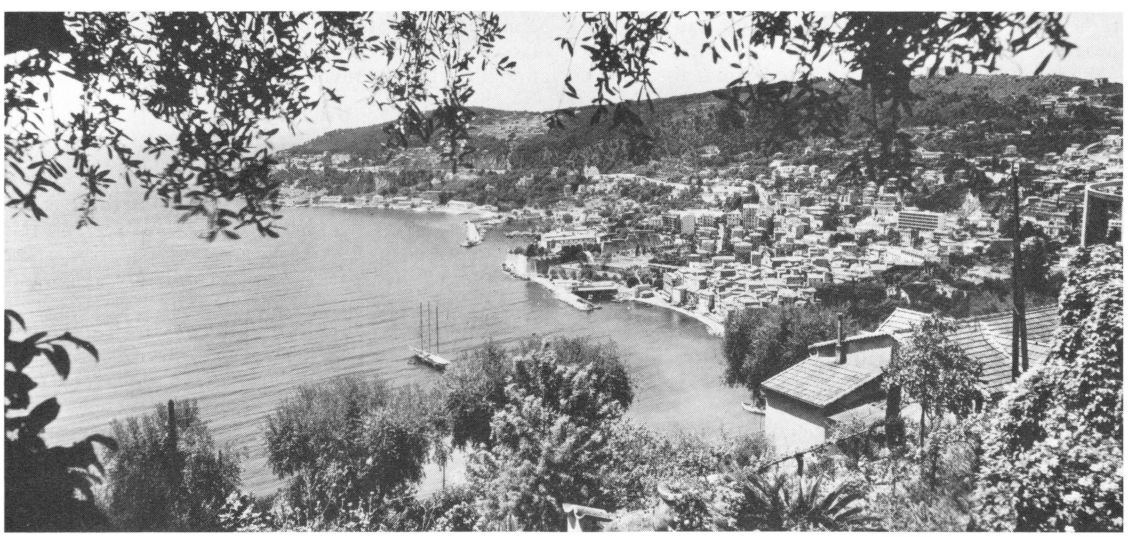
COTILLION, *koh TILL yun,* is a ballroom dance similar to the quadrille. It permits an endless variety of steps, and often consists of complicated figures. A head couple leads the rest of the dancers through the various steps and patterns. At least four couples do the dance, but any number of additional couples may join in. The cotillion was one of the most popular dances of the 1800's. The term *cotillion* also refers to a gathering of people for social dancing. WALTER SORELL

COTOPAXI, *KOH toh PAK see,* in the Andes Mountains of Ecuador, is the highest active volcano in the world. It is 40 miles (64 kilometers) south of Quito, Ecuador. Its nearly perfect cone, with slopes of about 30 degrees, rises 19,347 feet (5,897 meters) above sea level, and is covered with glaciers and snow fields. Its crater is about 2,600 feet (792 meters) across. During the last 400 years, it has erupted more than 25 times. Lava and hot ash cause snow on the flanks of the cone to melt rapidly, sending big flows of mud pouring down the mountainside. An explosive eruption occurred in February, 1942. GORDON A. MACDONALD

See also MOUNTAIN (picture chart).

COTTAGE CHEESE. See CHEESE (Cottage Cheese).

COTTAGE INDUSTRY was an economic system widely used during the Industrial Revolution. The worker agreed to make products, such as clothes, for someone who planned to sell them. The worker usually worked at home, but he often rented working space. The worker was not the employee of the person who sold the goods. He merely agreed to do the work, and could later refuse additional work. The system is also known as the *domestic system* or the *putting-out system.* See also INDUSTRIAL REVOLUTION (The Textile Industry).



French Government Tourist Office

Picturesque Villages Line the Côte D'Azur along the Mediterranean coast of France. Such towns as Villefranche, above, attract visitors who enjoy the area's balmy climate and natural beauty.

Cotton

Cotton Ranks as the Main Source of Income for Farmers in the Southern United States.

COTTON is the most important fiber that man uses to make clothing. More than three of every four persons in the world wear cotton clothing. Cotton can be made into more kinds of products—from diapers to explosives—than any other fiber. The United States uses about 4 billion pounds (1.8 billion kilograms) of cotton a year, an average of about 20 pounds (9 kilograms) for each person.

More than $9\frac{1}{2}$ million Americans depend on cotton for at least part of their livelihood. Farmers, businessmen, and industrialists have invested more than $24 billion in producing and processing cotton. Russia and the United States are the world's leading producers of cotton. Asia, Latin America, Africa, and Europe also produce large cotton crops.

Eli Whitney invented the *cotton gin* in 1793. This machine made it possible to *gin* cotton, or remove the cotton seeds from the fibers, more cheaply. With it, one man could do the work once done by 50 men picking out seeds by hand. Before the Civil War, cotton ranked as the only important crop of the South. Slaves toiled in the cotton fields of great plantations, cultivating and picking the snowy crop.

Cotton still ranks as the main source of income for southern farmers. But now they also raise other crops, as well as livestock. Fluffy white cotton bolls cover the fields of the cotton-producing states during autumn. Many places in the South have celebrations in honor of cotton. For example, Memphis, Tenn., holds an annual Cotton Carnival.

Uses of Cotton

All parts of the cotton plant are useful. The most important part is the *lint* (fiber) used in making cotton textiles. *Cottonseed* provides oil and forms the base of many food products. The *linters*, or short fuzz on the seeds, are used in making cushioning, paper, plastics, and other products. Farmers plow under the *stalks* and *leaves* as humus to improve soil structure.

Cotton-Fiber Products. Lint is used to make all kinds of clothing, from hats to shoes. Cotton has strength and toughness for work clothes. But it can also be spun into fine cloth for dressy gowns. Household goods made of cotton include rugs, towels, and bed sheets. Other cotton-fiber products include bandages, bookbindings, and auto seat fabrics. Chemists have made

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International Harvester; Rod Heinrichs/Grant Hellman

cotton fireproof, waterproof, rotproof, shrinkproof, and wrinkle-resistant. Specially treated cotton shirts and dresses need no ironing.

Cottonseed Products. Oil is the most important product made from cottonseed. In some cotton-oil mills, machines crush the kernels of the seed and squeeze out the oil. Other mills roll out the kernel so that it looks like oatmeal. These mills then use chemicals to dissolve the oil out of the seed. *Refined* (purified) cottonseed oil forms the base for such products as margarine, salad oil, shortening, and a frozen dessert made of vegetable fat called *mellorine*. The remains of the refining process are used in still other products, such as soap, linoleum, and phonograph records.

Meal remains after the oil is removed from the cottonseed. The proteins in this meal make it a valuable food for farm animals. The *hull*, or outer covering of the cottonseed, is used for cattle feed, chemicals, and as mulching material.

Cotton-Linters Products. Many industries use chemically treated linters as raw materials for such products as plastics, photographic film, paper, and sausage casings. Explosives manufacturers use linters in guncotton (see GUNCOTTON). Linter fibers are also used to stuff mattresses, cushions, and pads. Linters that have been cleaned, bleached, and sterilized are used as medical cotton.

Kinds of Cotton

There are four main kinds of cotton: (1) American upland, (2) Egyptian, (3) Sea-island, and (4) Asiatic. The various kinds of cotton plants resemble each other in most ways. But they differ in such characteristics as color of flowers, character of fibers, and time of blooming. Each main kind has varieties with different characteristics. Some varieties grow best on irrigated land. Some have lint $1\frac{3}{4}$ inches (44 millimeters) long, and others have lint only $\frac{1}{2}$ inch (13 millimeters) long. Some varieties have stronger fibers than others. Some are easier to harvest by machine than other varieties. Some grow best in certain parts of the world.

PRODUCTS FROM COTTON FIBER

Abrasives	Filter cloth	Slip covers
Adhesive tape	Gloves	Suits
Awnings	Handkerchiefs	Tablecloths
Bags	Hose	Tarpaulins
Bathing suits	Hosiery	Tents
Bedspreads	Insulating material	Thread
Bedticking	Luggage	Towels
Blankets	Overalls	Trousers
Blouses	Pajamas	Twine
Bookbindings	Pillowcases	Umbrellas
Carpets	Play clothes	Underwear
Coats	Sheets	Uniforms
Conveyor belts	Shirts	Upholstery fabric
Diapers	Shoelaces	Window shades
Draperies	Shoes	Zipper tape
Dresses		

PRODUCTS FROM COTTONSEED

Artificial leather	Glycerin	Paints
Cattle feed	Linoleum	Salad oil
Chemicals	Margarine	Shortening
Cosmetics	Mellorine	Soap
Fertilizer		

PRODUCTS FROM COTTON LINTERS

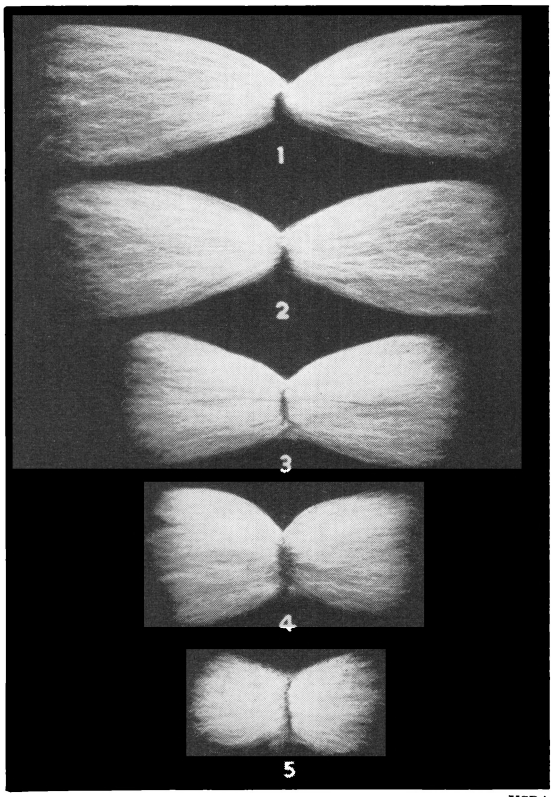
Absorbent cotton	Lacquer and enamel	Phonograph records
Adhesives	Linoleum	Plastics
Cellophane	Mattresses	Thermal insulation
Celluloid	Mops	Varnish
Cellulose	Paper	Weatherproofing materials
Cushioning	Photographic film	
Explosives		

Cotton farmers in cool temperate regions must plant their crops every year. But in the hot, moist tropics, cotton plants may bloom for several years. Some of these plants grow over 10 feet (3 meters) high.

American Upland Cotton is raised in almost every cotton-producing country. This hardy plant produces a large yield under various growing conditions. Upland cotton makes up two-thirds to three-fourths of the world's cotton crop. It can be made into many kinds of fabrics, from coarse to fine. It is used both for heavy canvas and for expensive shirts.

The upland cotton plant may grow 1 to 7 feet (30 to 213 centimeters) tall. It has creamy-white flowers, and white fibers $\frac{7}{8}$ to $1\frac{1}{4}$ inches (22 to 32 millimeters) long.

Egyptian Cotton was developed from stocks that originated in South and Central America. *Karnak*, the most famous variety, has strong fibers about $1\frac{1}{2}$ inches (38 millimeters) long. But it has now been replaced by *Menoufi*, a higher-yielding variety. Growers in the



USDA

The Chief Commercial Types of Cotton are: (1) Sea-island; (2) Egyptian; (3) American upland long-staple; (4) American upland short-staple; and (5) Asiatic.

United States and Peru have developed several varieties called American Egyptian cottons. *Pima S-2*, an American-Egyptian variety, has uniform fibers about $1\frac{3}{8}$ inches (35 millimeters) long.

Egyptian cotton has lemon-colored flowers and long, silky, light-tan fibers. It is made into clothing, balloon cloth, typewriter ribbons, and other fine fabrics.

Sea-Island Cotton first grew on the Sea Islands off the coast of South Carolina, Georgia, and northern Florida. It now comes from the West Indies.

Sea-island cotton is one of the most valuable and costly kinds of cotton. Its silky fibers are about $1\frac{3}{4}$ inches (44 millimeters) long. It can be made into high-quality textiles. But it is expensive to raise, because it grows slowly and has a low yield and small bolls. The plant has brilliant yellow flowers and white lint. Technically, Sea-island is closely related to Egyptian cotton. But growers consider it a separate kind of cotton, because of its commercial importance.

Asiatic Cottons grow mainly in China, India, and Pakistan. Chinese and Indian cottons have short, coarse, harsh fibers, and low yields. They are used for blankets, padding, filters, and coarse cloth. Varieties of American upland cotton are rapidly replacing the Asiatic cottons, because they have fibers of better quality.

The Cotton Plant

The plant described in this section is American upland cotton, the most widely grown kind. Other kinds of cotton plants resemble American upland. This plant grows upright and has branches spreading in all directions. It has broad leaves with three to five lobes. Its *taproot* (long main root) may grow as deep as 4 feet (1.2 meters) into the ground.

The Flower. White flowers blossom from the *squares* (buds). The flowers open in midmorning and begin to wither the next day. They turn pink, blue, and finally purple as they dry and fall off the plant. The flowers must be pollinated during the few hours they remain open. Cotton plants usually pollinate themselves (see POLLEN AND POLLINATION).

At first, only one or two flowers open each day. The first flowers bloom low on the plant, near the main stem. As the plant becomes larger, several flowers open daily. These flowers open higher on the plant and farther out on the branches. Flowering starts in summer and may last until the autumn frosts.

The Boll, which contains the cotton fibers, begins to form while the flower withers. A boll matures in 45 to 60 days. It grows to about the size of a golf ball. At full size, it is green and almost round, with a pointed tip. At this stage, the boll cracks in four or five straight lines from the tip. Then it splits open, showing four or five *locks* (groups of 8 to 10 seeds with fibers attached). The open dried boll, which holds the fluffed-out cotton, is called the *bur*.

Cotton-Growing Regions

The United States produces about $10\frac{1}{2}$ million bales of cotton a year. It ranks second only to Russia in production. A bale of cotton weighs about 500 pounds (227 kilograms), including packaging. United States farmers produced 526 pounds of cotton lint per acre (590 kilograms per hectare) in 1965, an all-time high yield.

In the 1920's, the United States grew more than half the world's cotton. The nation now produces only about one-fifth of the world's total. This is because other countries are growing much more cotton than they once did.

The *Cotton Belt* of the United States includes 14 states: Alabama, Arizona, Arkansas, California, Georgia, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas. Texas is the leader among the states in cotton production.

The cotton-textile industry in the United States uses about 8 million bales of cotton a year. Mills in the Southeast and in New England spin this cotton into textile products that are sold throughout the world. The United States exports an average of $3\frac{1}{4}$ million bales of cotton each year. The nation imports about 70,000 bales every year. The imported cotton is made up mainly of special cotton with long fibers, which is not widely grown in the United States, or short, coarse Asiatic cotton.

Other Countries. Cotton grows in many countries in Asia, including Afghanistan, Burma, China, India, Iran, Israel, Pakistan, Asiatic Russia, Syria, Thailand, and Turkey. In South America, farmers raise cotton in Argentina, Brazil, Colombia, and Peru, among other countries. The principal Central American cotton-producing countries are El Salvador, Guatemala, Honduras, Mexico, and Nicaragua. The leading cotton-growing countries in Africa include Chad, Egypt, Mo-

zambique, Nigeria, Sudan, Tanzania, Uganda, and Zaire. In Europe, cotton grows in Bulgaria, Greece, European Russia, southern Spain, the lower part of the Italian peninsula, and Yugoslavia. Australia also produces cotton.

How Cotton Is Grown

Today's farming methods have largely changed cotton growing. Once, it was produced almost entirely by hand and mule labor. Today, it is produced scientifically, with little labor and large amounts of supplies and equipment. In 1930, a farmer worked about 270 hours to produce one bale of cotton. Today, it takes him an average of about 27 hours.

Cotton grows best in fertile, well-drained soil that gets adequate moisture during the growing season. Farmers prefer dry weather after the bolls open. Cotton requires a warm to hot climate with about 180 frost-free days during the growing season.

Preparing the Soil. After harvesting a crop, cotton growers shred the stalks and plow them into the soil, or leave them on the surface to prevent erosion. In spring, they plow the soil. Then they use machines called *middlebusters* to prepare *beds* (low ridges) in which they plant the cotton seeds. Some farmers plant seed on a flat field, others between the beds.

Cotton needs fertile soil, so most growers use large amounts of fertilizer. In most situations, the fertilizer is placed a little to the side and below the seed. Many farmers rotate cotton with other crops. Farmers sometimes grow winter legumes or other cover crops in cotton fields between seasons (see LEGUME). Good cover crops add or help maintain organic soil matter as well as provide protection against erosion. Legumes may add nitrogen, an element needed by cotton plants.

Planting and Cultivating. In the United States, most farmers plant cotton in April or May. Farmers use two-, four-, six-, or eight-row tractor-mounted planters to open *furrows* (grooves) in the earth. The planters drop the cotton seeds into the ground, apply fertilizer, close the furrows, and press down the soil. This is done in one operation. At the same time, many farmers also apply weed-control chemicals and soil fungicides. Some planters sow seeds in solid *bands* (rows), but most drop the seeds at regular intervals, called *hills*. Rows normally are about 40 inches (100 centimeters) apart.

When solid band planting is used, the farmer thins the seedlings to prevent crowding. Thinning is usually done with a hoe, and is called *chopping*. Groups of two or three cotton plants are left in hills or clusters 6 to 10 inches (15 to 25 centimeters) apart. From 30,000 to 60,000 plants remain per acre (75,000 to 150,000 plants per hectare).

Chemicals may now be used on cotton planted in hills to control weeds and avoid the need to cultivate by hand or with tractors. Flamers may be used to burn small weeds near the base of the cotton plant in combination with tractor cultivation.

Control of Pests and Disease. In an average year, a cotton farmer loses 1 bale of every 8 because of insect damage, and 1 bale of every 7 or 8 because of disease.

The most harmful insect pests include the boll weevil, bollworm, pink bollworm, lygus, thrips, and aphid. Powerful dust or liquid insecticides can control all these pests except the pink bollworm. But no single spray or dust destroys all insects. The farmer uses the poisons that will kill the insects which attack his plants. Airplanes or machines on the ground apply the insecticides in a fine, mistlike spray or powdery dust that drifts onto all parts of the cotton plant (see INSECTICIDE).

Cotton growers try to keep the pink bollworm under control by isolating infected fields, sterilizing seeds and cotton, and by using machines that chop up leaves and other trash from the cotton. Shredding stalks as soon as the crop is harvested and plowing them under helps control the pink bollworm and the boll weevil.

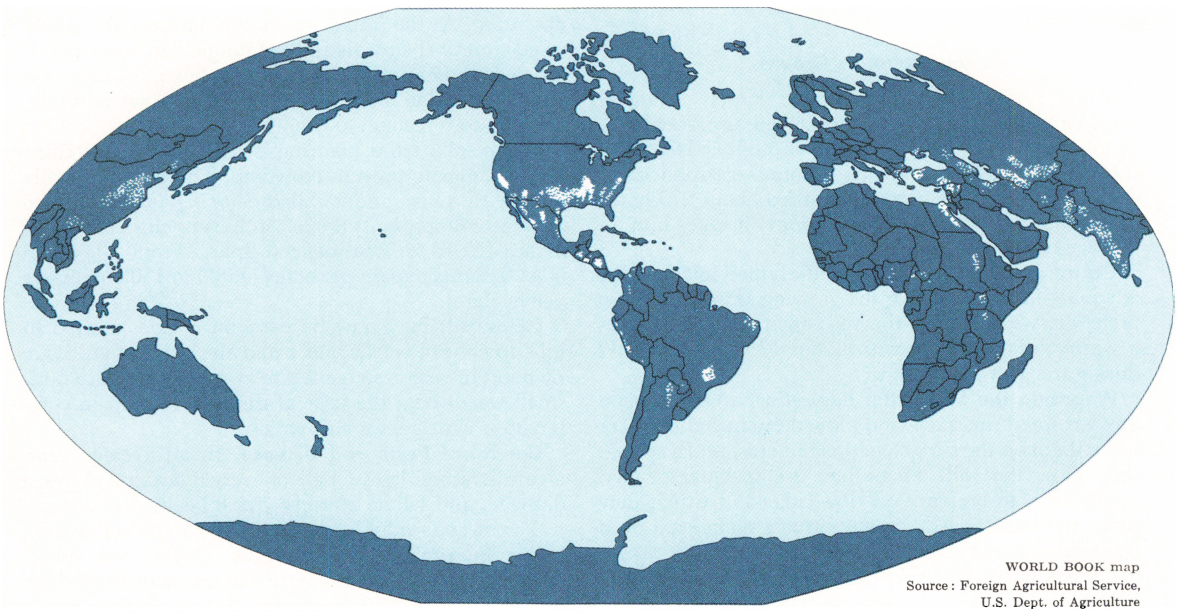
Stages in the Growth of the Cotton Plant include the *square,* or bud, *center;* the fully opened flower, *left;* and the boll, *right.* Leaflike bracts surround the bud, flower, and boll.

The Cotton Plant at Harvesttime looks as if it has clusters of fluffy snowballs. The ripened bolls pop open exposing the cotton fibers which are ready for picking by machine or hand.

National Cotton Council

WHERE COTTON GROWS IN THE WORLD

The United States produces about one-fifth of all the cotton raised in the world. Other cotton-producing countries include Brazil, China, Egypt, India, Mexico, Pakistan, Russia, Sudan, and Turkey. Each dot represents 50,000 bales of cotton.



WORLD BOOK map
Source: Foreign Agricultural Service, U.S. Dept. of Agriculture

LEADING COTTON-GROWING COUNTRIES

Bales (500 pounds, or 227 kilograms) grown in 1971

Russia	11,100,000 bales
United States	10,473,000 bales
China	6,900,000 bales
India	5,600,000 bales
Pakistan	3,250,000 bales
Brazil	3,150,000 bales
Turkey	2,250,000 bales
Egypt	2,200,000 bales
Mexico	1,710,000 bales
Sudan	1,150,000 bales

Source: *World Agricultural Production and Trade*, May, 1972, U.S. Department of Agriculture

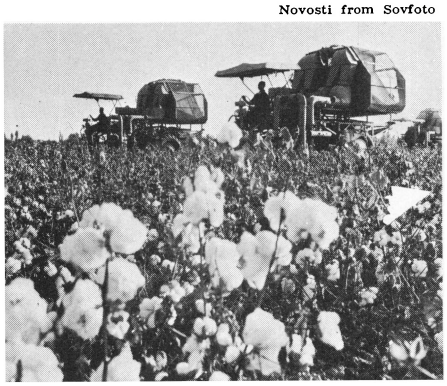
Small worms called *nematodes*, which can only be seen with a microscope, attack the roots of the cotton plant. They cut off the plant's food and water supply, so that it wilts or becomes stunted, and produces a smaller yield. Nematodes can be controlled by fumigating the soil or planting resistant crops in rotation.

There are two kinds of cotton diseases: (1) diseases of the *seedlings* (young plants), and (2) diseases of the older plants. Treating the seeds or spraying the seedbed with fungicides before planting controls seedling diseases (see FUNGI; FUNGICIDE). Fungicides also protect sprouting cotton. Diseases of older cotton plants, such as wilt and blight, may be partially controlled by using disease-resistant varieties.

Picking Cotton. In the United States, machines harvest almost three-fourths of the cotton crop. The rest is picked by hand. In the Cotton Belt, thousands of workers travel daily from towns and cities to nearby farms to pick cotton. The pickers remove cotton fibers and seeds from the burs by hand. They put the cotton in large sacks that they drag along the ground behind them. Late in the season, pickers may *snap* the cotton (pick the burs along with the seeds and fibers).

Russia

Novosti from Sovfoto



China

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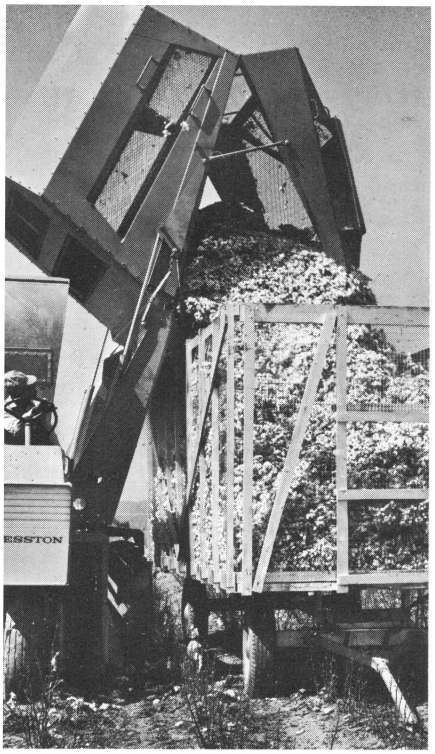
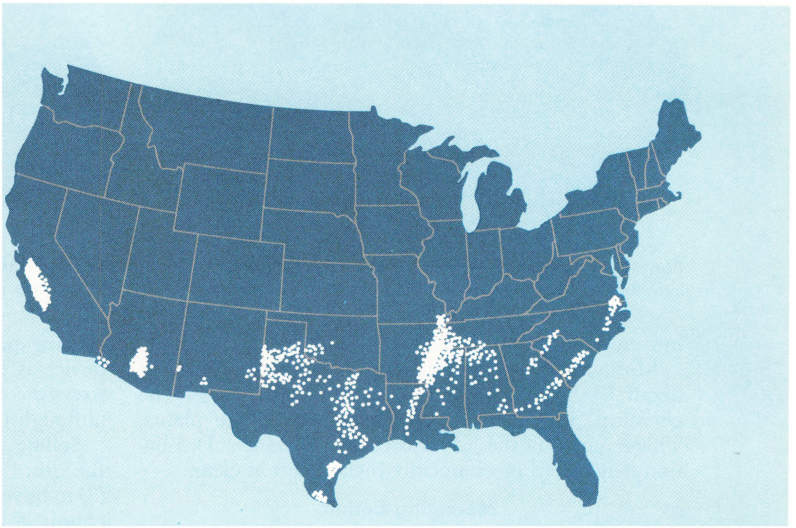


Grant Heilman

United States

WHERE COTTON GROWS IN THE UNITED STATES

The leading cotton-producing areas are in Texas, the Mississippi River Valley, California's San Joaquin Valley, and southern Arizona. Each dot represents 25,000 bales.



Sources: U.S. Dept. of Agriculture; *National Atlas of the United States.*

WORLD BOOK map

Machine harvesting is done by *stripping* or *picking*. Stripping machines are used in areas where soil, climate, and variety cause the cotton plant to be relatively small. This is the cheapest method of harvesting. Most stripping is done in Texas and Oklahoma. As the stripper moves along the rows of cotton plants, two long, revolving rollers break off the bolls, twigs, and leaves. So much trash remains in the cotton picked by a stripper that it must be cleaned by gins specially equipped for the purpose.

Farmers in other parts of the Cotton Belt use picking machines. These pickers pull the cotton from the bolls in one or two rows of cotton at a time. A one-row mechanical picker can do the work of about 40 hand pickers. Mechanical pickers use revolving spindles to pick the cotton. Some pickers have slender grooved rods as spindles. Others have larger cone-shaped, barbed spindles. As the mechanical picker moves down the row, the rapidly revolving spindles reach into all parts of the plants. The barbs or grooves in the spindles catch the cotton and pull it out of the burr. A stationary stripper mechanism or revolving rubber *doffers* remove the cotton from the spindles. Then the cotton is blown

LEADING COTTON-GROWING STATES

Bales (500 pounds, or 227 kilograms) grown in 1971

Texas
2,614,000 bales

Mississippi
1,693,000 bales

Arkansas
1,236,000 bales

California
1,118,000 bales

Alabama
640,000 bales

Louisiana
600,000 bales

Tennessee
528,000 bales

Arizona
508,000 bales

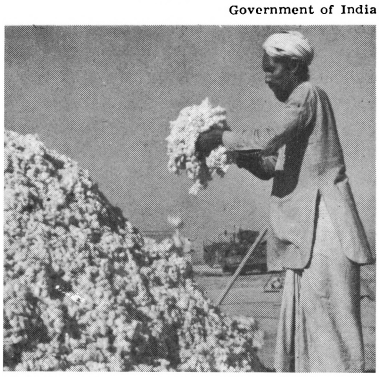
Missouri
401,000 bales

Georgia
374,000 bales

Source: *Cotton Situation*, May, 1972, U.S. Department of Agriculture

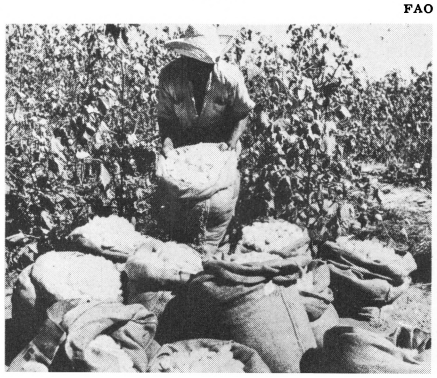
India

Government of India



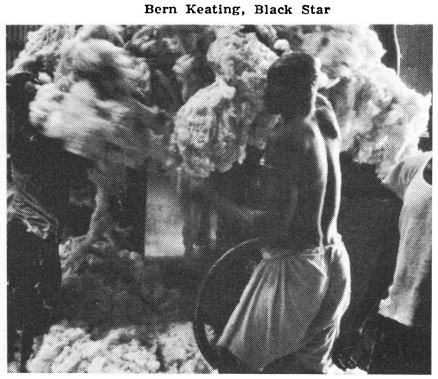
Brazil

FAO

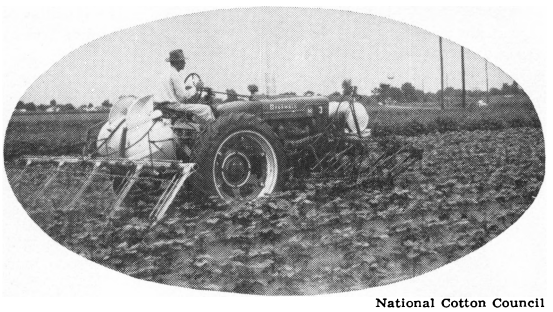


Sudan

Bern Keating, Black Star



Four-Row Cotton Planter prepares furrows and drops seeds into them. Wheels press the soil firmly over the seeds.



National Cotton Council

Tractor-Mounted Cultivator works on four rows at a time. The tractor has a flame cultivator at the rear, used to burn weeds.

into a large steel basket on the picker machine.

Most growers spray or dust their fields with chemicals about 10 days before picking cotton by machine. The chemicals kill the leaves, which drop off the plants. This removal of the leaves is called *defoliation*. Defoliation helps keep mechanically picked cotton clean.

Marketing Cotton

Ginning and Baling. Cotton gins remove the cotton fibers from the seeds. At the gin, seed cotton passes through the *drier*, a machine that dries the cotton. *Burr machines* and *cleaners* remove burrs, leaves, and other trash. Then the cotton goes to machines called *gin stands*, which pull the lint off the seeds. Lint is further cleaned in *lint-cleaning machines*.

Next, the lint goes to the *bale press*, which packs it into 500-pound (227-kilogram) bales. These bales measure about 56 by 28 by 45 inches (142 by 71 by 114 centimeters), or about the size of a large home refrigerator. Six yards (5.5 meters) of jute or other bagging material covers each bale. Six steel ties bind each bale.

Trucks carry the bales from the gin to a warehouse for storage. In order to save freight charges, compressing machines squeeze each bale to nearly half its original size. A railroad boxcar can carry 100 or more compressed bales. Bales for export are compressed to almost one-third their original size. A crew of 25 men operating a huge machine can compress about two bales a minute.

Classing. Cotton buyers and sellers judge cotton on the basis of samples cut from the bales. In the United States, most farmers send their samples to government classing offices. These offices are part of the Department of Agriculture. They are located in areas of high cotton production. Skilled classers judge the value of the cotton on the basis of grade, staple, and preparation.

Grade shows the amount of trash in the sample, the color of the fiber, and any discoloration due to insects and disease. The chief grades of white fibers are, from best to poorest: (1) Good Middling, (2) Strict Middling, (3) Middling, (4) Strict Low Middling, (5) Low Middling, (6) Strict Good Ordinary, and (7) Good Ordinary.

Staple is the length of the lint. Classers pull a cotton sample between their thumbs and forefingers several times to straighten the fibers. They discard most of it until a pinch of well-aligned fibers remains. *Staple length* is the average length of these fibers.

Preparation shows the quality of the ginning. Poor ginning produces cut or snarled fibers. A mechanical device is often used to determine fiber fineness. The strength of the fiber may be measured mechanically, although this is done less frequently.

Selling. Farmers normally sell their cotton (1) at the gin, (2) to cotton merchants in nearby towns, or (3) to buyers or agents for textile mills. Any place where cotton is bought and sold for immediate delivery is called a *spot market*. Some farmers belong to cooperative marketing associations that sell their cotton.

Several southern cities, the chief spot markets, have *cotton exchanges*. All accredited cotton merchants in these markets belong to the exchanges. The exchanges make rules for the local market, settle disputes between merchants, and post the prices and cotton-market news from throughout the world. The U.S. Department of Agriculture publishes prices daily from some markets.

New York has a *futures exchange*. There, agreements are made to buy or sell cotton at a stated price at a stated future time. A merchant or spinner who buys cotton on the spot market can protect himself against the risk of a change in price by selling a futures contract in a futures exchange. When he sells his cotton or cloth, he buys back his futures contract. This is called *hedging* against a price change (see BOARD OF TRADE [Futures Market]).

Making Cotton into Cloth

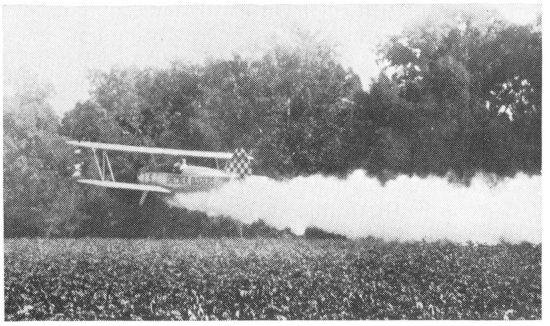
Cleaning. When cotton arrives at a textile mill, workers remove the steel ties and bagging that hold the bales together. *Blending machines* open the bales and mix and break up the compressed layers of cotton. Several blenders feed cotton into *cleaning machines*, which further mix the cotton, break it into smaller pieces, and remove trash.

The cotton is sucked through a pipe to *picking machines*. Beaters in these machines strike the cotton repeatedly. They knock out dirt, and separate lumps of cotton into smaller pieces. The picking machines form the lint into a *lap* (long rolled sheet).

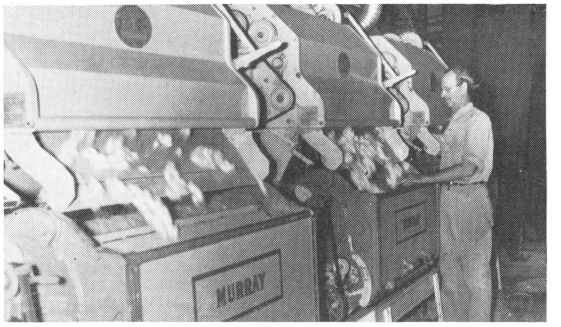
Cotton then goes to a *carding machine*, where the fibers are separated. Trash and short fibers are removed. Some cotton goes through a *comber* that takes out more short fibers and makes a stronger, more lustrous yarn.

Spinning. The spinning processes basically do three jobs: (1) they *draft* the cotton, or reduce it to smaller and smaller structures; (2) they *straighten* and *parallel* the fibers; and (3) they put *twist* into the yarn. Several

National Cotton Council; James Sawders

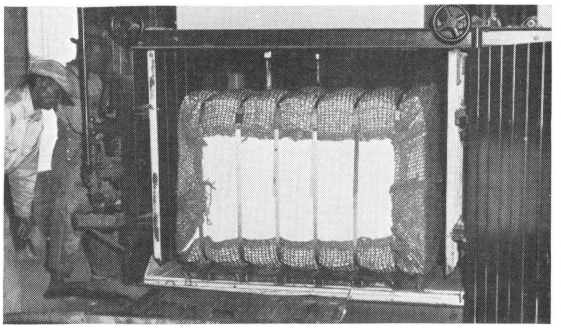


Airplanes Spray or Dust Cotton Fields with insecticides and *defoliants*, or chemicals that cause the leaves to drop off the plant.



At the Cotton Gin, machines called *gin stands* pull the cotton fibers off the seeds. Other machines clean the fibers.

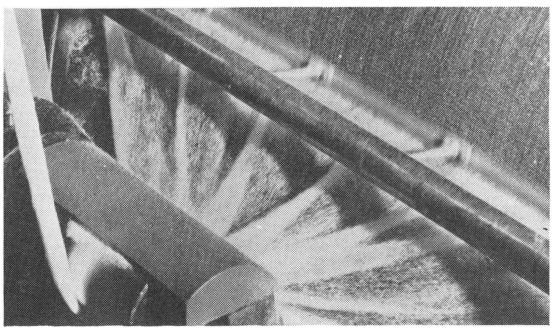
National Cotton Council



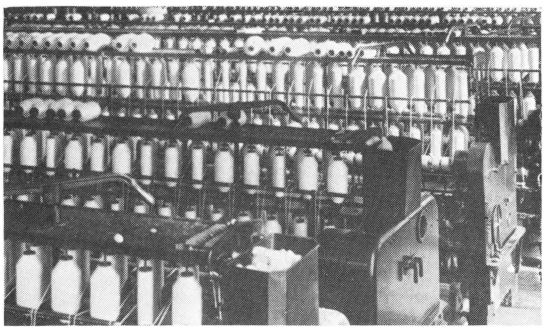
Bale Presses at the gin pack the cotton into bales. Presses at the warehouse compress the bales more.

In the Cotton Classing Room, skilled classers examine samples of cotton to determine the grade and staple of the fibers.

National Cotton Council; Keystone View, FPG

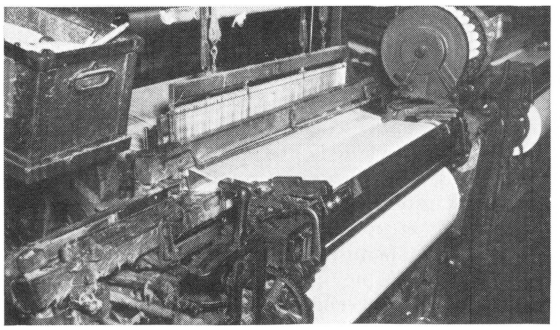


Carding Machines straighten the cotton fibers. Then the fibers are brought together to form a *sliver*, or loose rope.

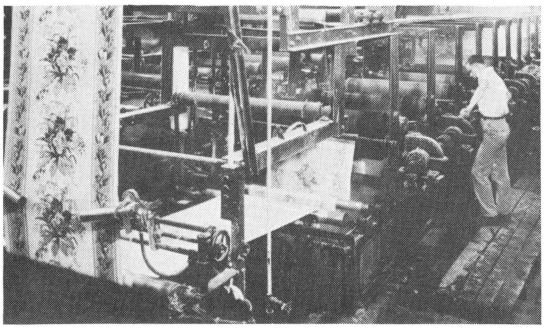


Spinning Frames twist the fibers to make a fine, strong yarn. Many yarns are tied end to end to form one long yarn.

National Cotton Council

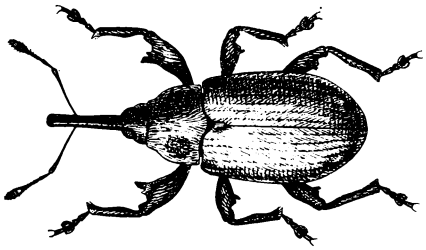


A Mechanical Loom automatically weaves hundreds of yarns into cloth. One weaver can tend up to 40 mechanical looms.

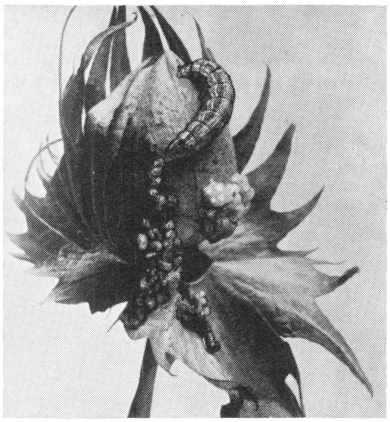


Chemicals are Added to Printed Cloth to make sure that the colors of the pattern remain bright permanently.

ENEMIES OF COTTON

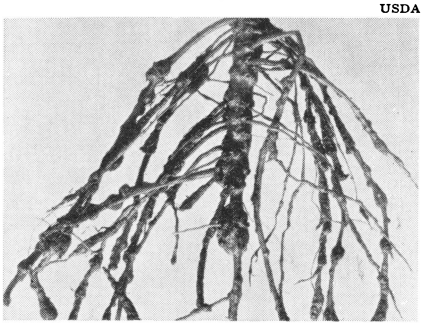


The Boll Weevil, *above,* causes great damage to cotton crops. The larvae of this insect feed on the fibers inside the cotton boll.



Aphids and Bollworms attack cotton. Aphids, *left,* suck juices from leaves and stems. Bollworms, *above,* attack the leaves and bolls.

Nematodes may attack the cotton roots and keep the plants from getting food from the soil. USDA



different machines perform these jobs. See SPINNING; SPINNING JENNY.

Yarn is the final product of spinning. It must be twisted to give it strength and to make the fibers cling together. Many yarns are tied end to end to form one long yarn. Yarns to be woven lengthwise in cloth are *warped* (wound side by side) on a gigantic spool called a *beam.* Several hundred yarns can be wound on each beam. Several beams fit into a *slashing machine.* This machine unwinds the yarns and feeds them through a vat of *sizing* (a mixture of starch, gum, and resins). Then it dries and rewinds the yarns. Sizing strengthens the yarns and protects them during weaving. Looms weave yarn into cloth (see WEAVING [How Cloth Is Woven]).

Finishing. After inspectors check the cloth, the sizing is dissolved in hot water and washed away. Some cloth passes through a gas flame that singes the fuzz off its surface. Boiling the cloth in an alkaline solution in a tightly closed *kier* (large vat) removes any natural waxes, colored substances, or discolorations. Then the cloth is bleached in hypochlorite or peroxide. Manufacturers put some cloth into a strong solution of sodium hydroxide to *mercerize* it (see MERCERIZING). Mercerization adds luster to the cloth and makes it stronger. The cloth may then pass through a machine that prints various designs on it. Cloth intended to be solid-colored goes through a *dye bath.*

Colored yarns are used to weave designs into some fabrics. These yarns are kiered, bleached, and dyed before warping and sizing. Wrinkle-resistant and easy-care cloth passes through mixtures of chemicals that link the fiber molecules and give them desired qualities.

History

Early Days. The Aztec Indians grew cotton for textile purposes nearly 8,000 years ago in Mexico. Asiatic cottons first grew wild in East Africa. About 5,000 years ago, the people in what is now Pakistan cultivated cotton. The Persians brought cotton-growing methods from India. The ancient peoples used cotton for clothing, for bindings for sandals, and even for harnesses for elephants. Greek and Roman travelers described cotton plants as the fleece of tiny lambs growing on trees. The Greek historian Herodotus wrote about a tree in Asia that bore cotton "exceeding in goodness and beauty the wool of any sheep."

The army of Alexander the Great first brought cotton goods into Europe in the 300's B.C. The cloth cost so much that only the very rich could afford it. In the A.D. 700's, Moslem invaders brought cotton-manufacturing processes to Europe. Italians and Spaniards wove some cotton, but the art spread northward slowly.

The English began to weave cotton in the 1600's. They imported raw cotton from the countries bordering the eastern edge of the Mediterranean Sea. Later they imported cotton from the southern colonies in America. In the 1700's, English textile manufacturers developed machines that made it possible to spin thread and weave cloth in large quantities (see INDUSTRIAL REVOLUTION). Then they began to export cotton cloth.

In America, early explorers found that Indians knew how to make cotton clothing. In the early 1600's, southern colonies began growing cotton. The colonists wove cotton into coarse cloth for their own use. Large-scale cotton growing began in the late 1700's.

English manufacturers tried to keep cotton-mill machinery out of the United States. They wanted the United States to sell its raw cotton to England and buy back finished cloth. Samuel Slater, an English textile worker and mechanic, learned how these machines were made. He came to the United States in 1789. Slater supervised the building of cotton mills in New England in the 1790's. One of these mills, Old Slater Mill, built in 1793, still stands in Pawtucket, R.I. (see RHODE ISLAND [Places to Visit]; SLATER, SAMUEL).

Cotton manufacturing in New England grew rapidly. In 1793, Eli Whitney invented the cotton gin, which made it possible to send more cotton to the mills.

The demand for cotton increased, and the southern cotton industry expanded. Cotton became so important to the South that people called it "King Cotton" and

sang songs about it. Slave traders brought Negroes to the United States to provide cheap labor. The great plantations of the Old South had many slaves and often covered 2,000 to 3,000 acres (810 to 1,200 hectares). But most southern farmers had small farms and only a few slaves or none at all. Southern farmers felt strongly that they could not make money from growing cotton without the cheap labor provided by slaves. This became one of the causes of the Civil War.

Cotton Mills Move South. After the Civil War, Southerners began to build their own factories to make cotton cloth. Land was cheap and taxes were low. Southern laborers worked for lower wages than the workers in northern mills. By the 1920's, the South was producing more cotton cloth than New England. This move to the South continued through the 1940's and 1950's. Today, most cotton mills are located in the southeastern states, near cotton-farming areas. These states have ample power and the labor needed to run the mills.

Technical Advances. Until the late 1800's, most cotton seeds were thrown away as waste. The value of cottonseed as a source of oil was recognized as early as the late 1700's. But there was no machinery to extract the oil. John Lineback of Salem, N.C., patented the first cottonseed-hulling machine in 1814. But practical machinery to produce oil, meal, and other products did not go into operation until the mid-1800's. Today, about 95 per cent of the cottonseed crop is crushed. Farmers use the rest for planting.

Today, cotton must compete with the many synthetic fibers. To help in this competition, chemists have developed ways to improve cotton cloth. Chemicals applied to the cloth make it permanently crisp, wrinkle-resistant, flame retardant, waterproof, resistant to mildew, stronger, and more lustrous. Well over one-fourth of the cotton cloth is now treated in this way.

Manufacturers may combine cotton fibers with wool, rayon, linen, and synthetic fibers to produce cloth with special qualities. New weaves and chemical finishes have made it possible to produce textured cotton, cotton tweeds and suiting materials, silky cottons such as faille and chiffon, tufted cotton for rugs, and many other kinds of textiles.

Economic Problems that face the American cotton farmer include competition from man-made fibers and rising production costs. In the mid-1960's, cotton accounted for more than half the total amount of fibers processed by U.S. textile mills. By 1975, cotton's share of the textile market had dropped to less than a third.

The federal government has tried to help the farmer through a price-support program. The program includes a *support level* for cotton. When the market price of cotton falls below this level, the government will loan a farmer the price-support value of his crop. The government takes the crop as security. If the market price rises sufficiently before the loan period expires, the grower may pay off the loan and sell his cotton on the market. Otherwise, the government takes possession of the cotton.

Since 1966, the loan price has been far below the average cost of producing cotton. Increased production costs have resulted mainly from the higher prices farmers must pay for equipment, fertilizer, and fuel. In 1974, the government began another program to help cotton farmers. Under this program, the government periodically sets a *target price* for cotton. If the market price falls below the target price, the government provides payments to the farmer to make up the difference. The availability of these payments has encouraged farmers to plant enough cotton to assure a sufficient supply.

Scientific Classification. Cotton is in the mallow family, *Malvaceae*. Cotton makes up the genus *Gossypium*. There are about 20 species, but only 4 of them are cultivated. American upland cotton is genus *Gossypium*, species *G. hirsutum;* Egyptian and Sea-island cottons are *G. barbadense;* and the Asiatic cottons are *G. herbaceum* and *G. arboreum*. Each of these four species includes several varieties.

DABNEY S. WELLFORD

Related Articles in WORLD BOOK include:

COTTON CLOTHS

Batiste	Crepe	Haircloth	Percale
Broadcloth	Cretonne	Huck	Piqué
Brocade	Crinoline	Jersey Cloth	Poplin
Buckram	Denim	Khaki	Shantung
Calico	Dimity	Lace	Swiss
Cambric	Drill	Lisle	Terry Cloth
Canvas	Duck	Madras	Ticking
Chambray	Flannel	Mosquito Netting	Velveteen
Chenille	Foulard	Muslin	Voile
Chintz	Gabardine	Nainsook	
Corduroy	Gauze	Organdy	
Covert	Gingham		

OTHER RELATED ARTICLES

Boll Weevil	Guncotton	Textile
Cellulose	Mali (picture)	Thread
Cotton Gin	Pink Bollworm	Weaving
Egypt (Agriculture)	Rayon	Whitney, Eli
Farm and Farming	Spinning	

Outline

I. **Uses of Cotton**
  A. Cotton-Fiber Products
  B. Cottonseed Products
  C. Cotton-Linters Products
II. **Kinds of Cotton**
  A. American Upland Cotton
  B. Egyptian Cotton
  C. Sea-Island Cotton
  D. Asiatic Cottons
III. **The Cotton Plant**
  A. The Flower
  B. The Boll
IV. **Cotton-Growing Regions**
  A. The United States
  B. Other Countries
V. **How Cotton Is Grown**
  A. Preparing the Soil
  B. Planting and Cultivating
  C. Control of Pests and Disease
  D. Picking Cotton
VI. **Marketing Cotton**
  A. Ginning and Baling
  B. Classing
  C. Selling
VII. **Making Cotton into Cloth**
  A. Cleaning
  B. Spinning
  C. Finishing
VIII. **History**

Questions

What is the leading cotton-growing country?
What important invention decreased the cost of producing cotton?
What is the most important cottonseed product?
What is the *Cotton Belt?*
How are airplanes often used in growing cotton?
How large is a bale of cotton?
What is a *cotton exchange?*
What is a *spot market?* a *futures exchange?*
How do explosives manufacturers use cotton?
In what way has the United States government tried to help the cotton grower?

COTTON, JOHN (1584-1652), was a Puritan minister and author. He was born in Derby, England. While

serving as vicar of St. Botolph's Church in Lincolnshire from 1612 to 1633, he became widely known as a pastor and preacher. In 1633, Cotton fled to America to escape persecution as a Puritan. While serving with a church in Boston, he became one of the most respected leaders of New England. Many New England children memorized his catechism, *Milk for Babes* (1646).

Cotton believed that church and state should be close partners, and he often advised both about proper government. He opposed unrestrained democracy, in which people ruled themselves. Cotton believed that the people should choose their rulers, who should govern according to certain unchanging principles. Cotton became New England's spokesman against the democratic political and religious views of Roger Williams, founder of the Rhode Island colony. L. C. RUDOLPH

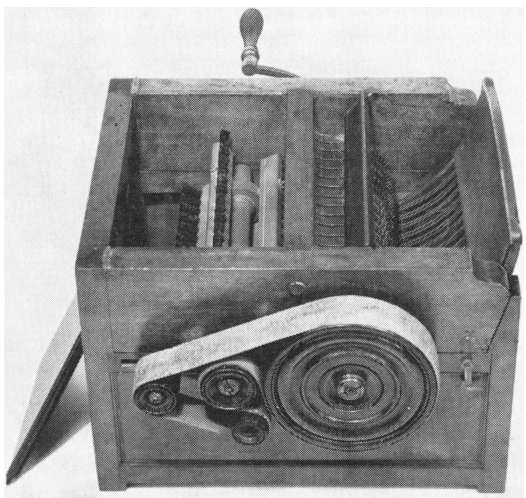
COTTON BELT. See COTTON (The United States).

COTTON BOWL. See FOOTBALL (table).

COTTON GIN is a machine invented in 1793 by Eli Whitney for separating cotton fiber from the seed. The cotton gin helped make cotton the chief crop of the southern United States. Before the invention of this machine, it took a person a full day to hand pick the seeds from a pound of cotton fiber. The word *gin* comes from the Old French *engin*, meaning *engine*.

Modern gins use the same principle as the first machine. Harvested cotton is fed through a row of about 70 saws that make from 350 to 500 revolutions a minute. The saws have a 12-inch (30-centimeter) diameter, and are placed about $\frac{5}{8}$ inch (16 millimeters) apart. The teeth on the saws pull the cotton from the seeds. Ginning ribs between the saws prevent the seeds from passing through. Brushes or air jets remove the fiber on the teeth of the saws.

Hand-harvested cotton comes to the gin relatively clean. But machine-picked cotton contains much more leaf and stem trash. The modern gin must use additional equipment to clean the fiber. A *precleaner extractor* removes much of this trash before ginning. It consists of a vertical column with four rows of saws, one above the other. As the saws rotate, they drag the cotton over *grid bars* that scrub off the trash. Brushes remove the cotton from the saws. A. D. LONGHOUSE



U.S. National Museum

The Cotton Gin. Saws that pull the cotton from the seeds are visible at the right of this model of Eli Whitney's machine.

See also COTTON; WHITNEY, ELI.

COTTONMOUTH. See WATER MOCCASIN.

COTTONSEED OIL is an edible oil used in salads and cooking or made into margarine and shortening. Manufacturers remove the hulls from cottonseed. They steam the seeds and place them in hydraulic presses, which extract the oil. One short ton (0.9 metric ton) of cottonseed provides about 310 to 320 pounds (141 to 145 kilograms) of oil. The defatted seeds and hulls are used as food for livestock. See also COTTON (Cottonseed Products); OIL (Fixed); VEGETABLE OIL.

COTTONTAIL. See RABBIT.

COTTONWOOD is a group of large, spreading, poplar trees that grow in the United States. These trees grow quickly and make good shade trees, but are short-lived. Early in spring, their small, greenish flowers droop in long clusters called *catkins*, and form masses of cottony seeds. The cottonwoods' shiny green leaves are shaped like a triangle, and have wavy, toothed edges. The thick, dull gray bark splits into ridges and long furrows. Cottonwoods grow in moist soils, especially along rivers.

The eastern cottonwood grows throughout the eastern regions of the United States. *Black cottonwood*, the tallest western broadleaf tree, grows along the Pacific Coast. The whitish or light brown wood of these trees is soft and weak. Manufacturers use it for boxes and crates, furniture, pulpwood, and excelsior. Cottonwood is the state tree of Kansas, Nebraska, and Wyoming.

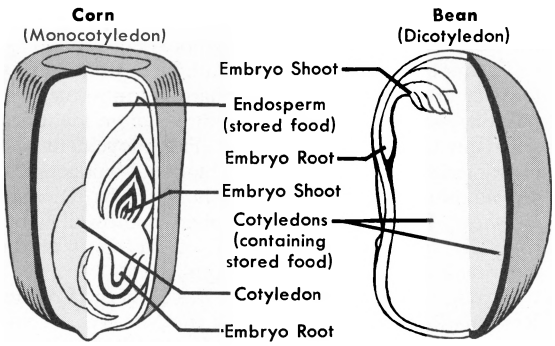
Scientific Classification. Cottonwoods belong to the willow family, *Salicaceae*. The eastern cottonwood is genus *Populus*, species *deltoides*. The black cottonwood is *P. trichocarpa*. ELBERT L. LITTLE, JR.

See also CATKIN; LEAF (picture: Kinds of Tree Leaves); POPLAR; TREE (Familiar Broadleaf and Needleleaf Trees [picture]).

COTTRELL, FREDERICK GARDNER (1877-1948), an American chemist, invented the Cottrell Electrical Precipitator in 1910. Using up to 100,000 volts, this machine removes smoke and other impurities from big industrial smokestacks. Valuable by-products are recovered, and clean air results.

Cottrell also developed helium production for airships and became an expert on nitrogen fixation, or changing nitrogen in the air into more useful compounds. In 1912, he founded the Research Corporation and endowed it with his many patent rights in the field of electrical precipitation. Earnings from these finance new scientific research and the training of future scientists. Born in Oakland, Calif., Cottrell studied at the universities of California and Berlin, and received his Ph.D. from the University of Leipzig. HERBERT S. RHINESMITH

COTYLEDON, *KAHT uh LEE duhn*, is the name given to the first leaves formed from a seed. These first leaves store and digest food for the new plant that is forming. The cotyledons are really part of the seed. They are usually thick and blunt. When a seed begins to sprout, a tiny stem and roots develop from the different tissues in the embryo of the seed. As the embryo grows, it uses up all the food stored in the seed. The cotyledons



Cotyledons are present in the seeds of all flowering plants. Many kinds of seeds, including those of corn, contain only one cotyledon, *above left*. But a great many other plants, including the broad bean, have seeds with two cotyledons, *above right*. Botanists use this difference in classifying flowering plants.

help in this process by digesting the stored food and moving it to the embryo.

In some plants, such as beans, the *cotyledons* (seed leaves) cling to the stem and develop green coloring matter. Then they begin to manufacture food for the new plant through photosynthesis (see PHOTOSYNTHESIS). When the plant grows other leaves, the cotyledons dry up and fall off. In other plants, as in peas, the cotyledons do not come above ground.

There are two types of cotyledon formation in the seeds of *angiosperms* (flowering plants). One type of seed has two cotyledons and is called a *dicotyledon*. A bean is a typical two-cotyledon seed. The rest of the seed, which consists of a *plumule* (tiny shoot) and the hypocotyl (tiny root), is tucked between the two cotyledons. Reserve food is stored in the two fleshy cotyledons. After a bean is soaked in water, the skin can be peeled off, and the bean can be split into two parts. The two thick parts of the bean are the cotyledons. In other dicotyledons, the cotyledons are thin and the food of the seed is stored outside of them.

The other kind of seed of flowering plants, a *monocotyledon*, has a single cotyledon next to the plumule and hypocotyl. Reserve food is stored outside the cotyledon. A grain of corn is a typical single-cotyledon seed. ARTHUR W. GALSTON

See also ANGIOSPERM; DICOTYLEDON; GERMINATION; MONOCOTYLEDON; SEED.

COUBERTIN, PIERRE DE. See OLYMPIC GAMES (History).

COUGAR. See MOUNTAIN LION.

COUGH is a sudden, explosive expelling of air from the lungs. The air is forced out through the mouth, in contrast to sneezing in which the air comes through the nose (see SNEEZING). Coughing and sneezing are important body defenses, because they help rid the breathing channels of harmful irritants. But they can also spread infection or disease.

When irritating substances enter any part of the respiratory system, a special set of nerves is stimulated. These nerves act to cause a short, deep intake of air. The *glottis*, or opening of the larynx, closes. This creates great air pressure in the lungs. Suddenly the glottis opens and the captured air rushes out in a blast, pushing before it any foreign substance in its path. A person can make himself cough whenever he wants. But he finds it difficult to stop a cough that results from irritating substances. ALBERT P. SELTZER

COUGHLIN, *KAWG lihn*, **CHARLES EDWARD** (1891-), an American Roman Catholic priest, became well known before World War II for his political activities. In radio addresses and his paper, *Social Justice*, he favored inflation and isolationism. His bishop reproved him for his activities. Born in Hamilton, Ont., he was assigned to the Shrine of the Little Flower at Royal Oak, Mich., in 1926. Father Coughlin retired from the shrine in 1966. MATTHEW A. FITZSIMONS

COULEE. See GRAND COULEE DAM.

COULOMB, *koo LAHM*, is the unit that measures the quantity of electricity flowing past a section of an electric circuit in one second when the current is one ampere. An electric current carrying one coulomb per second is called a current of one *ampere*. Ampere is the unit of rate or strength of flow. The name *coulomb* was given to the unit to honor the French physicist Charles A. de Coulomb. E. R. WHITEHEAD

See also AMPERE; FARAD.

COULOMB, *koo LAHM*, **CHARLES AUGUSTIN DE** (1736-1806), a French scientist, inventor, and army engineer, made fundamental contributions in the fields of friction, electricity, and magnetism. He formulated *Coulomb's Law*, which states that the force between two electric or magnetic charges varies inversely as the square of the distance between them. He invented a number of instruments for measuring magnetic and electric forces. He also published papers on friction in machinery. The unit for the quantity of electricity, the coulomb, was named in his honor.

Coulomb was born in Angoulême. He was educated in Paris and entered the French Army. After nine years of army service in the West Indies, he devoted himself to scientific research. ROBERT W. ABBETT

COUMARIN. See ANTICOAGULANT.

COUNCIL. Many councils of various types are listed in THE WORLD BOOK ENCYCLOPEDIA under the key word. Example: HEALTH COUNCIL, NATIONAL.

COUNCIL, CITY. See CITY GOVERNMENT.

COUNCIL FOR MUTUAL ECONOMIC ASSISTANCE. See WORLD (map: Major Economic Organizations of the World); COMMON MARKET.

COUNCIL OF BLOOD. See ALVA, DUKE OF.

COUNCIL OF ECONOMIC ADVISERS. See ECONOMIC ADVISERS, COUNCIL OF.

COUNCIL ON FOREIGN RELATIONS is a private organization that studies problems in United States foreign policy. The council aims to develop new approaches to, and an understanding of, international relations. It does not, however, support or oppose any course of action.

The council encourages the publication of books on foreign affairs. Most of these books are written by a single author. The author, who need not be a council member, receives advice from a study group made up of experts who are members. Since 1922, the council has published a quarterly magazine called *Foreign Affairs*.

The Council on Foreign Relations sponsors about 150 meetings yearly for members. Leading statesmen and experts in foreign affairs address the meetings. The

council offers fellowships to selected individuals to broaden their knowledge of foreign affairs.

The council was established in 1921 and has 1,500 members. It selects members for their experience and interest in foreign affairs. More than 30 committees on foreign relations in cities throughout the United States are associated with the council. The council has headquarters at 58 E. 68th Street, New York, N.Y. 10021. Critically reviewed by the COUNCIL ON FOREIGN RELATIONS

COUNSELING. See VOCATIONS (Vocational Guidance; Vocational Counseling as a Career); GUIDANCE.

COUNSELOR. See LAWYER.

COUNT is a title of honor going back to the days of the Roman Empire. The Latin word *comes* means *companion* or *follower*, and was used to indicate the companions of the Roman proconsuls. From this came the Spanish title *conde*, and the French *comte*. *Count* came into the English language as a translation of foreign titles equal to the English *earl*.

See also EARL.

COUNTER REFORMATION is the name generally given to the renewal movement in the Roman Catholic Church during the 1500's and 1600's. Many Catholic scholars prefer the terms *Catholic Reformation* or *Catholic Revival* to avoid the implication that the movement was merely a reaction to the Protestant Reformation.

Reform movements in the church had begun long before the rise of Protestantism. During the 1400's, clergymen such as Girolamo Savonarola in Italy and Francisco Ximenes in Spain began to stir the conscience of the church against abuses that developed during the Renaissance. But the spark that set off a complete renewal of Catholic faith and practice was the rejection of the pope by Protestant reformers. This action awakened the zeal of Catholics to purify the church "in head and members," from the pope down.

Pope Adrian VI, who reigned from 1522 until his death the next year, described the church as it had been just before the Protestant Reformation: "We frankly acknowledge that God permits this persecution of the Church on account of the sins of men, and especially of prelates and clergy. . . . We know well that for many years things deserving of abhorrence have gathered around the Holy See; sacred things have been misused, ordinances transgressed, so that in everything there has been a change for the worse. . . ."

The Counter Reformation took two main forms: (1) a rebirth of faith among the people, and (2) a reassessment of principles by church leaders. Religious zeal was stimulated by the establishment of new religious orders in the early 1500's. With the founding of the Society of Jesus (Jesuits) in 1534, the Counter Reformation became an established fact.

The Council of Trent, held from 1545 to 1563, determined the manner in which Catholic life and worship were to be renewed. The council defined the nature of grace and man's salvation, the sacrifice of the Mass, the priesthood, the seven sacraments, and church authority. It also authorized seminaries for the training of priests, decreed ecclesiastical clothing for the clergy, issued a catechism of doctrine, and required bishops to live in their dioceses. In addition, the council encouraged the establishment of schools; insisted that priests, nuns, and monks practice poverty; and promoted the sending of missionaries throughout the world.

The renewal of faith among Catholics affected every form of art. For example, the baroque movement in painting, sculpture, and architecture is often identified with the Counter Reformation. This movement was characterized by dramatic and emotional works of art. In literature, the English Catholic poets Richard Crashaw, John Dryden, and Robert Southwell wrote intensely spiritual works typical of the spirit of the Counter Reformation. See BAROQUE.

Two factors contributed to the success of the Counter Reformation: (1) the discovery of the New World, and (2) the Industrial Revolution. The colonization of North and South America helped the church realize its desire to extend the frontiers of Christianity. Industrialization brought large numbers of Catholics from rural to urban areas. This migration led to the formation of parishes and Catholic schools, and the development of a distinctive Catholic culture. JOHN A. HARDON

See also REFORMATION; ROMAN CATHOLIC CHURCH; TRENT, COUNCIL OF.

COUNTERFEITING, *KOWN tuhr FIHT ihng*, is the production of any article in imitation of another, but especially the unlawful production of imitations of money. Printing and coining money is the function of a national government. One who counterfeits commits a crime against the government.

Technically, counterfeiting is different from *duplication*. Counterfeiting is the imitation of the coins in less valuable material. In duplication, coins of the same metallic value are made by unauthorized persons. In the United States, counterfeiters are tried in federal district courts. Prison sentences range from 5 to 20 years, and fines from $5,000 to $10,000. FRED E. INBAU

See also MONEY (Printing Paper Money); SECRET SERVICE, UNITED STATES.

COUNTERGLOW. See ZODIACAL LIGHT.

COUNTERPOINT is the combination of several melodies at once. Music today is usually written with a single melody and supporting chords. Counterpoint is written with several melodies that form chords when they are played together. Singing several popular songs together creates a *quodlibet*. Any harmonies in it are purely accidental, but the harmonies in counterpoint are intentional. Counterpoint is also called *polyphony*, from the Greek words *poly*, or *many*, and *phony*, or *voices*. Contrapuntal music includes the canon and the round, such as "Three Blind Mice," and the fugue.

Counterpoint developed about 1100. Monks at that time sang *organum*, with several parts parallel to the melody of a plain chant. Later the separate voices were allowed to move in different directions and new styles of counterpoint developed. Counterpoint then reached high points in the 1500's, with the music of Giovanni Palestrina of Italy and William Byrd of England, and in the 1700's, with the fugues of Johann Sebastian Bach. GRANT FLETCHER

See also CANON; FUGUE; ROUND.

COUNTESS. See EARL.

COUNTING. See ARITHMETIC.

COUNTRY is a term that means any independent nation with a definite name and a geographic boundary. About 150 countries are generally recognized as independent. The number has steadily increased since

World War II as more colonies have become independent. In size, the countries of the world range from Vatican City, which covers 108.7 acres (44.0 hectares), to Russia, with over 8,649,500 square miles (22,402,100 square kilometers). There are eight huge countries, each with more than 1 million square miles (2.6 million square kilometers), and about 55 large ones covering from 100,000 to 1 million square miles (260,000 to 2.6 million square kilometers). There are about 30 medium-sized countries with over 40,000 square miles (100,000 square kilometers); about 35 that include from 3,000 to 40,000 square miles (7,800 to 100,000 square kilometers); and about 15 small ones covering less than 3,000 square miles (7,800 square kilometers). For lists of countries of the world, see the various continent articles, such as AFRICA (table: Independent Countries); also WORLD (table: Independent Countries of the World).

In a second meaning, the term *country* may refer to a region that is not necessarily a political unit and does not usually have exact boundaries. The Bluegrass Country of Kentucky is an example. SAMUEL N. DICKEN

See also BOUNDARY.

COUNTRY AND WESTERN MUSIC is the traditional music of whites of the rural Southern United States. It first appeared during the 1800's among the pioneers in such areas as Kentucky, North and South Carolina, Tennessee, and West Virginia. Since the mid-1940's, the popularity of this music—now called simply *country music*—has spread throughout the United States and to many other countries.

Style. Many influences helped shape country music. Immigrants from England, Ireland, and Scotland brought their ballads, country dances, jigs, and reels to America. This music had a great impact on the developing music of the rural South. Religion played an important role in Southern pioneer communities, and so sacred and inspirational themes became important musical source material. The railroads, which linked isolated towns with the outside world, also provided a significant theme.

Jim Marshall, Photon West

Country and Western Music Performers rehearse a song at a folk music festival. From left to right are Johnny Cash, Carl Perkins, and Doug Kershaw.

Country music composers have always written about love—both moral and immoral. They especially write about the punishment and feelings of guilt that can accompany immoral love. This attitude toward the consequences of illicit love reflects the strict religious training and moral values of much of the rural South.

Southern Negro blues music also contributed song themes and influenced the instrumental style of country music performers. Elements of the blues ran through the songs of Jimmie Rodgers, who is considered the father of modern country music. Guitar techniques in Negro blues helped form the styles of such musicians as Chet Atkins, the Delmore Brothers, and Merle Travis.

History. Before 1920, country music existed almost entirely in the South. Performers sang their own songs and played such traditional instruments as the autoharp, dulcimer, fiddle, guitar, and mandolin. Today, popular instruments include the bass, drums, acoustical guitar, electric guitar, piano, and steel guitar.

The development of the broadcasting and recording industries hastened the spread of country music during the 1920's and 1930's. Radio stations throughout the Midwest, South, and Southwest broadcast country barn dances and jamborees. The most important of these radio programs was—and still is—"Grand Ole Opry." It was broadcast regularly from Nashville, Tenn., from 1925 to 1974, when the program moved to Opryland, an entertainment park near Nashville. From the 1920's through the 1940's, recording companies searched the South for country talent.

During the early 1940's, World War II brought population shifts that helped spread interest in country music. Rural Southerners began moving to urban areas in the Midwest, North, and West and took their music with them. Members of the U.S. armed forces carried the music to all parts of the world.

By the 1950's, country music had attracted many famous pop singers. Many songs by composer-singer Hank Williams became hits, including "Cold, Cold Heart" (1951) and "Your Cheatin' Heart" (1953).

Today, it is often difficult to separate country music from popular music or from rock music. Each of these forms has influenced the others. The country music industry produces many records that blend popular and country styles. But much traditional country material remains. PAUL ACKERMAN

COUNTRY LIFE. See FARM AND FARMING.

COUNTY is usually a division of local government. Almost all the states of the United States are divided into counties. Louisiana has *parishes* that correspond to counties. Connecticut is divided into eight counties and Rhode Island into five counties, but these counties are only divisions of the state court systems. The form of county organization and the number and powers of county officers vary from state to state. State legislatures determine the county boundaries.

In counties where large cities occupy the entire county area, city and county governments may be combined. Denver, Honolulu, and San Francisco, for example, have combined city and county governments. Some cities are not part of any county, and do not form a part of county government. In these cities, municipal officials perform many of the duties which

are ordinarily performed by county officials. Baltimore and St. Louis are examples of two cities which have governments of this kind.

Importance. The importance of county government varies with the section of the country. The county is especially important in the South and West. It is unimportant in New England, where the town is the center of local influence (see TOWN). In the Midwest and in the Middle Atlantic States, the county often shares authority with the township (see TOWNSHIP). County revenues are raised chiefly by taxes on personal property and real estate. State governments remit some parts of state-collected taxes to counties.

The number and size of counties vary from state to state and from region to region. The United States has 3,049 organized counties. Texas, with 254, has the largest number of counties. The number and type of county officers also vary from state to state.

County Governments usually have a *decentralized* administration, with no executive head. The main county institution is an elective board. In southern and western states, this board is generally called a *board of commissioners*. It consists of from 2 to about 15 members who are elected at large. In other states, especially in the Midwest and the East, the governing body is usually called a *board of supervisors*. It may have from 15 to 100 members who are elected from districts, wards, or townships. County officers are usually elected for terms of from 2 to 4 years. They may include county commissioners or supervisors, sheriff, prosecuting attorney or district attorney, coroner, registrar of wills, recorder of deeds, clerk of courts, jury commissioner, controller or auditor, surveyor, engineer, and others.

Duties. County governments may administer justice, assess and collect taxes, record official documents, and register voters. They may also administer roads, public education, zoning, and licensing. Some counties manage such functions as sewage disposal, jails, and relief systems. Some counties maintain parks, airports, hospitals, libraries, electric service, and water service.

The word *county* comes from the French *comte*, which was derived from the Latin *comitatus*, meaning *body of companions*. The French county was the domain of a count. The English began to call their *shires* counties about 1400. The English colonists brought the county system with them to America. DAVID FELLMAN

Related Articles in WORLD BOOK include:

Assessor	County Agricultural	District
Board of	Extension Agent	Attorney
Supervisors	County Extension	Sheriff
Coroner	Home Economist	Shire

COUNTY AGRICULTURAL EXTENSION AGENT is a public official who helps farmers and homemakers solve agricultural and family-living problems. Nearly every county in the United States has at least one agent. He receives funds and other assistance from federal, state, and county offices.

County agricultural extension agents work to help farmers improve their farming and financial management practices. They spend much of their time with poor farm families. In both rural and urban areas, agents advise 4-H leaders and provide information about gardening and insect control.

The agents also work with local leaders to improve rural communities. For example, they help develop plans to control pollution and try to make more jobs available for local people.

A county agricultural extension agent should have at least a bachelor's degree in some field of agriculture. He also needs a broad understanding of agricultural extension work. Critically reviewed by EXTENSION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

See also AGRICULTURAL EDUCATION (Cooperative Extension Work); COUNTY EXTENSION HOME ECONOMIST; FARM AND FARMING (The County Agent); 4-H.

COUNTY EXTENSION HOME ECONOMIST is a public official who helps families and homemakers of all ages solve problems related to homemaking. Extension home economists work in about two-thirds of the counties of the United States. They receive funds and various services from federal, state, and county offices.

The home economics program emphasizes consumer education and instruction about nutrition and the selection and preparation of food for a healthful diet. The program also teaches people how to improve their clothing, family relationships, health and sanitation, housing, and money management. Home economists teach by training and advising homemaker group leaders, 4-H leaders, and community leaders.

County extension home economists spend nearly half their time helping low-income families, especially in the field of nutrition education. In addition, more than 8,000 volunteers, called program aides, receive professional training and supervision. The aides teach their low-income neighbors how to improve their diet.

Most county extension home economists have a bachelor's degree in home economics. They must also be able to use extension methods. Critically reviewed by EXTENSION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

See also COUNTY AGRICULTURAL EXTENSION AGENT; 4-H.

COUNTY GOVERNMENT. See COUNTY.

COUP D'ÉTAT, *koo day TAH,* is a sudden take-over of a country's government by a group of conspirators. Usually, the conspirators are public officials who infiltrate and then use their country's armed forces, police, and communications to seize power. A coup d'état may lead to few or many changes in the government. Famous coups in history include those carried out by Napoleon Bonaparte in France in 1799, by the Bolsheviks in Russia in 1917, and by the Communists in Czechoslovakia in 1948. During the 1900's, most coups have occurred in politically unstable countries in Africa, Asia, Latin America, and the Middle East. *Coup d'état* is a French term meaning *stroke of state*. See also JUNTA. HOLBERT N. CARROLL

COUPÉ. See BUGGY.

COUPERIN, *koo PRAN,* **FRANÇOIS** (1668-1733), a French composer, musician, and teacher, won fame as a composer of sacred works and of music for the harpsichord. The harpsichord was the most important keyboard instrument of his time. He wrote a famous textbook, *The Art of Playing the Harpsichord.* He dedicated it in 1716 to the six-year-old King Louis XV of France.

Johann Sebastian Bach, the famous composer, greatly admired Couperin. Bach arranged one of Couperin's trios for the organ, and used some of the ideas expressed in Couperin's book in teaching his eldest son.

Couperin was born in Paris, a member of a family which produced about a dozen excellent musicians. He studied music with his father, Charles. In 1693, at the age of 25, he won a competition for the highly coveted post of organist to the king of France. Soon afterwards, he began teaching the royal children, including the crown prince. KARL GEIRINGER

COUPLET, *KUHP liht,* is a rhyme of two lines. The *heroic couplet* is an English metrical form in iambic pentameter, used in sequence.

A *closed* couplet emphasizes the rhyme, and completes a thought within two lines. For example:

> A perfect Judge will read each work of Wit
> With the same spirit that its author writ:
> Survey the Whole, nor seek slight faults to find
> Where nature moves, and rapture warms the mind . . .

In an *open* couplet, clauses and sentences end anywhere, and the rhyme is not emphasized. For example:

> A thing of beauty is a joy forever:
> Its loveliness increases; it will never
> Pass into nothingness; but still will keep
> A bower quiet for us, and a sleep
> Full of sweet dreams, and health, and quiet breathing.

John Dryden and Alexander Pope used the closed couplet brilliantly. Other poets used open couplets with great skill. They include Geoffrey Chaucer, George Chapman, and John Keats.

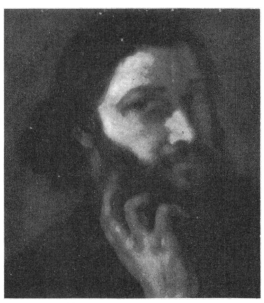
Less common forms include the *short couplet,* or four-stress lines; the *long couplet,* or six-stress lines; and couplets as a stanzaic form. CHARLES W. COOPER

See also METER; POETRY; RHYME.

COUPON. See BOND (picture); RATIONING.

COURANTE. See DANCING (The Renaissance).

COURBET, *KOOR BEH,* **GUSTAVE** (1819-1877), a French painter, is famous for his efforts to develop realism in French painting during the 1800's. Courbet painted his early works, such as *Man with the Leather Belt,* in a romantic style. But, in 1849, he exhibited *Burial at Ornans* and *After Dinner at Ornans,* both of which showed events of his day. These paintings, and others of untraditional "realist" subjects, such as *The Stone Breakers, Young Ladies of the Village,* and *Young Ladies by the Seine,* caused a scandal when they were exhibited.



M. H. De Young Memorial Museum, San Francisco, Hanley Collection.

Courbet's Portraits show his skillful and realistic treatment of human subjects. He painted *Mère Grégoire, right,* in 1855. The artist's self portraits, including the one above, provide a revealing record of his life.

In 1855, Courbet organized his own exhibit when the Salon, the official group sponsoring public exhibitions of paintings, refused to let him display his work. He painted *The Artist's Studio* for the show. This painting appears in color in the PAINTING article. Courbet called the picture "a real allegory of seven years of my artistic life," and painted himself surrounded by his friends and favorite subjects for painting.

He was born Jean Désiré Gustave Courbet in Ornans, France. In 1840, he moved to Paris, where he attended free drawing classes and copied paintings in the Louvre. He became involved in the Commune of Paris in 1871 and was imprisoned for his activities. He died in Switzerland. ROBERT GOLDWATER

See also BERLIOZ, LOUIS HECTOR (picture).

COUREURS DE BOIS, *koo RUR duh BWAH,* were French-Canadian frontiersmen of the late 1600's and the early 1700's who made their living trading for furs with the Indians. Canada was a colony of France, and private fur traders were required to get a license from the government at Quebec. The government issued very few licenses, and most coureurs de bois traded illegally. *Coureurs de bois* means *Vagabonds of the Forest.* The adventurous life of the coureurs de bois attracted many young men who were bored with farming.

The coureurs de bois sold brandy to the Indians, and the missionaries frowned on their activities. But these adventurers learned Indian languages and customs. They provided a link between the Indians and the French that helped to cement the alliance against the English during the French and Indian Wars. P. B. WAITE

COURNAND, ANDRÉ FREDERIC. See NOBEL PRIZES (table [1956]).

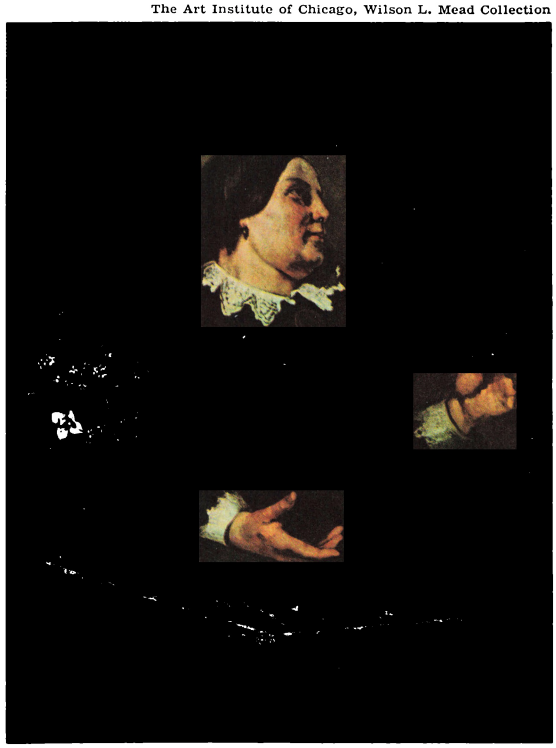
COURSE INDICATOR. See AIRCRAFT INSTRUMENTS (The Deviation Indicator).

COURSE OF STUDY. See CURRICULUM.

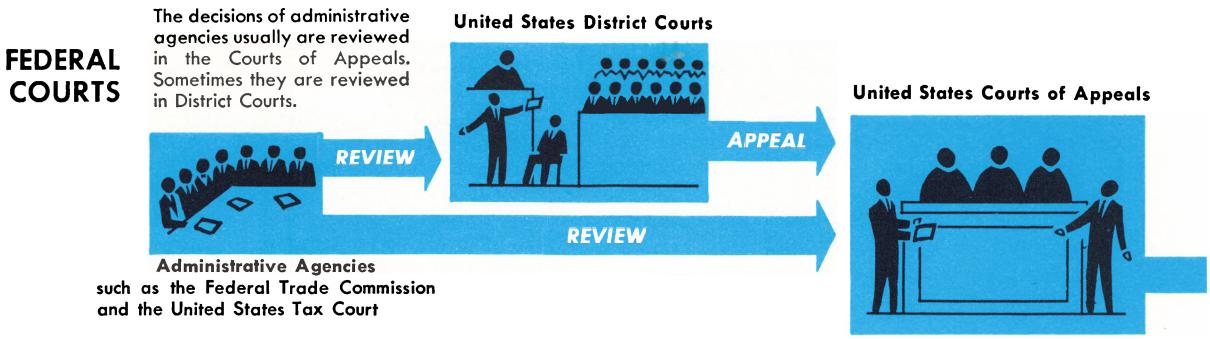
COURSER is a wading bird that has a short, curved bill, long legs, and short toes. It is brown in color. Coursers eat insects and nest on the ground. They live in temperate and warm parts of Africa, Asia, Australia, and Europe.

Scientific Classification. Coursers belong to the courser family, *Glareolidae.*

The Art Institute of Chicago, Wilson L. Mead Collection



The System of Courts in the United States



COURT is a government agency with the power to settle disputes between individuals or organizations. All courts use officials called *judges*. Some courts have *juries* as well as judges. The administrative work of the court is done by the *clerk* of the court. Courts also may have *marshals*, *sheriffs*, and *bailiffs*, to assist in enforcing the decisions of the court, and in keeping order during proceedings before the court.

The word *court* may also mean the place where judges and other persons regularly meet to settle legal disputes, or it may mean the gathering itself.

How a Court Works

To illustrate the workings of a British or American court, let us take an example of a dispute which the parties are unwilling to settle privately.

Suppose that you fall on a flight of stairs after visiting a friend at his apartment. You have broken your leg and suffered bruises, and you believe the accident resulted from the carelessness of the owner of the apartment house. You or your lawyer will talk to the owner and try to work out a settlement without going to court. But many cases cannot be settled by private talks. Let us assume yours is not settled.

If there were no courts, you would have to pay the costs of the accident, such as hospital bills, yourself, or use force to make the apartment house owner pay. But this is not always fair, and the government provides a court where you can tell your side of the dispute, and the owner can tell his. You will submit a written statement of your side of the event. This is called the *complaint*. Because you begin the lawsuit, you are called the *plaintiff*. The owner will be called the *defendant*, and the written report of his side of the story is called his *answer*. If he does not file an answer, he ordinarily will be considered at fault, and must pay you. By comparing the two sides, the lawyers and the court can see just where the difference of opinion lies.

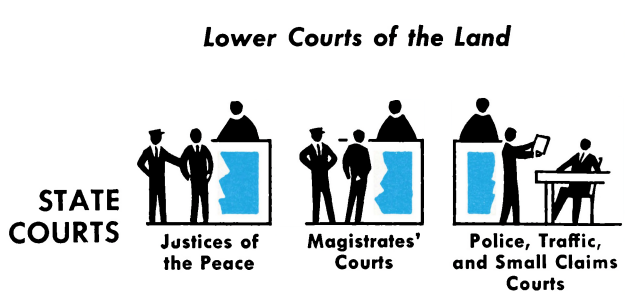
When the trial is held, you and the owner produce *evidence*, either written or given by witnesses, in an effort to show the truth in the case. A jury usually decides questions of fact, such as whether the carpeting on the stairs was torn or loose. If both sides wish it, the judge alone may decide questions of fact. The judge decides questions of law.

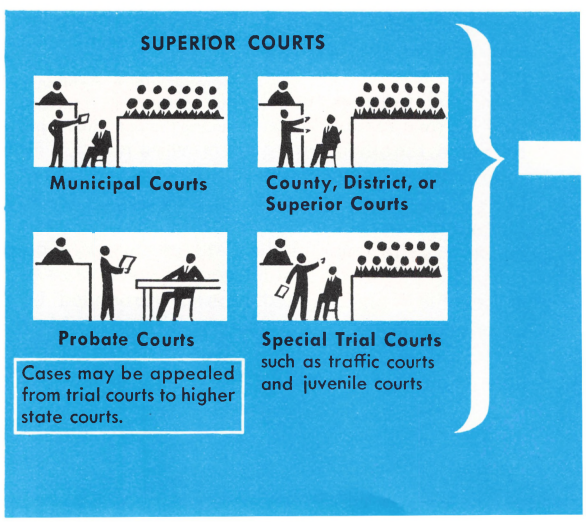
After all the evidence is in, the judge tells the jury about the rules of law in the case. Then the jury decides who wins. The jury's decision is called a *verdict*. The jury also decides how much money you are entitled to if you win the case. The court then gives a *judgment* embodying the verdict of the jury. If the court finds that the owner was careless, he will be ordered to pay you. But if the owner is not found at fault, you must bear the expense yourself.

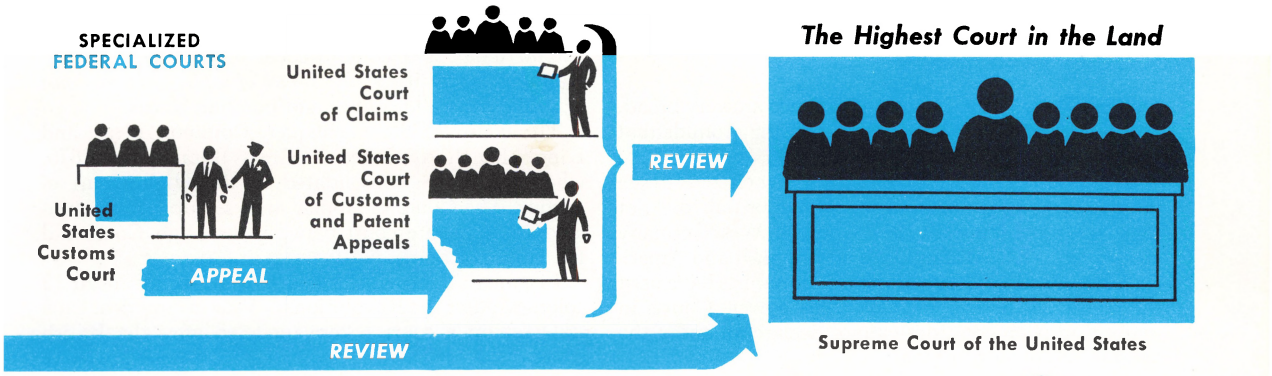
System of Courts in the United States

There are two systems of courts in the United States. One is maintained by the states, and the other by the federal government. The state courts began as courts of the American colonies. They became state courts when the colonies became states. The federal court system was provided for in the United States Constitution to interpret the Constitution, to settle disputes which go beyond the limits of one state, and to settle disputes among the various states.

Federal Courts. The Constitution provides that "the







judicial power of the United States shall be vested in one Supreme Court, and in such inferior courts as the Congress may from time to time ordain and establish" (Article III, Section 1). Federal courts handle cases involving the Constitution, federal laws, and cases in which the United States is a party. They also try cases between citizens of different states, cases in which other countries or their citizens are parties, and cases concerning ships at sea, called *admiralty* cases.

The system of federal courts is governed by a statute called the Judicial Code. The trial court, where cases are first heard, is called the *district court*. The United States and its possessions have about 90 district courts. The courts in Guam, the Virgin Islands, and the Panama Canal Zone are known as *territorial courts*. District courts in Puerto Rico are called *courts of the United States*. The *courts of appeals* rank above the district courts. One appellate court is located in each of the 11 judicial circuits into which the country has been divided. The highest federal court is the *Supreme Court of the United States*.

Cases tried in the federal courts usually are heard first in district courts, but there are special types of cases in which higher courts may have *original jurisdiction*. When federal cases are appealed, they usually go from the district court to a court of appeals. On rare occasions, they may go directly to the Supreme Court. In addition to reviewing trials in the district courts, the courts of appeals also review orders issued by administrative agencies such as the Securities and Exchange Commission and the Federal Trade Commission. Cases from state supreme courts also may go to the Supreme Court if some question of federal law is involved.

There are federal courts with special authority for certain kinds of cases, such as the *Court of Claims*, where individuals may sue on some claims against the federal government; the *United States Customs Court;* and the *Court of Customs and Patent Appeals*.

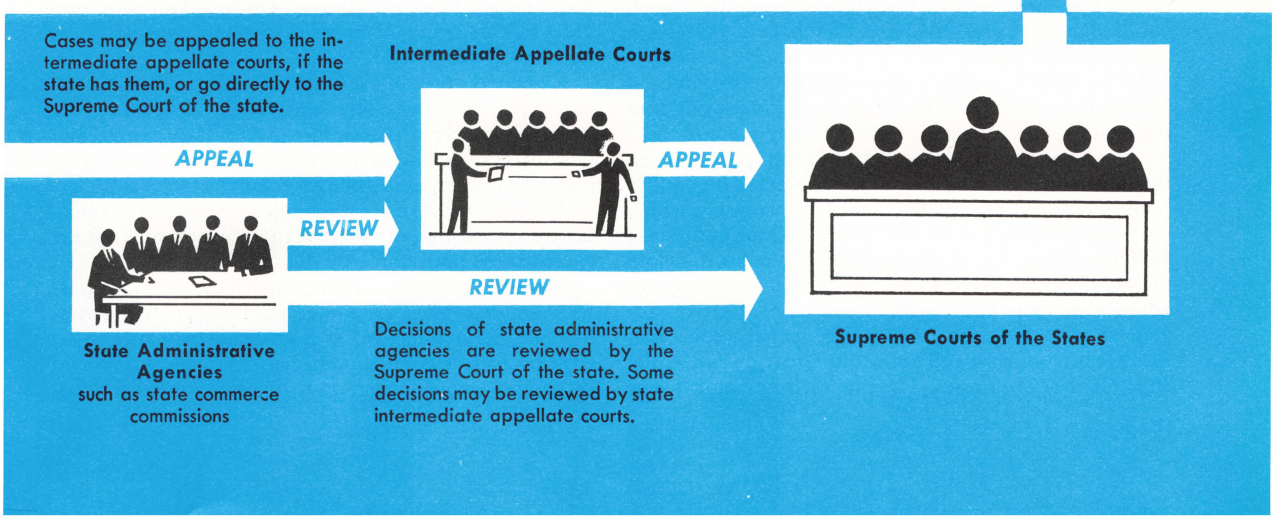
State Courts are much like federal courts in their methods of procedure. The lowest state courts often are the *magistrates' courts* in cities, and those of justices of the peace in villages and rural communities. Usually a person may choose to have his case heard in these courts, or in state trial courts. If he chooses these lower courts, he usually gives up his right to appeal. *County courts*, *municipal courts*, and other state superior courts are usually next higher. In many states, there is an intermediate court of appeals above the county or district courts. Appellate courts usually review the decisions of state administrative agencies. The highest court in a state is usually called a *supreme court*.

Other Court Systems

France and many of the nations of Europe use a system of civil law. In many cases, this makes court procedures quite different from those in English-speaking countries. For example, the *Assize* courts, which handle grave criminal cases and misdemeanors in connection with the press, are the only courts in France which have juries. Most French courts have panels of

Cases from state supreme courts may be reviewed by the Supreme Court of the United States if some question of federal law is involved.

REVIEW



judges. The rules for admitting evidence are very broad, and no person can refuse to testify on the grounds that he may incriminate himself.

Both France and West Germany allow citizens to sue their governments for damages. Great Britain did not make this provision until 1947. Courts in West Germany are a mixture of German forms and English and American ideas. In East Germany, the Communists have used the courts as tools to increase their power. Courts in many European countries cannot declare an act of the legislature unconstitutional.

The courts of Canada include the Supreme Court, the Federal Court, and the provincial courts. The governor general appoints all judges of these courts.

International Courts

International courts differ in two ways from the courts within a country. First, nations, and not private citizens or corporations alone, come to an international court for justice. Second, no nation is forced to make use of international courts, or to abide by their decisions. But many persons believe international courts should have the power to enforce their decisions.

The Permanent Court of Arbitration was set up by The Hague Peace Conferences of 1899 and 1907. It consists of a group of experts on international law. When a problem arises in which arbitration is needed, five judges are selected from this group to act as arbitrators. The International Court of Justice now is a part of the United Nations. It meets at the Hague to settle any disputes brought before it. See INTERNATIONAL COURT OF JUSTICE; INTERNATIONAL LAW.

History of Courts

The structure of the court systems of the United States and Canada is based in general on that of England. The earliest English courts were local ones. They were organized in villages, manors, and counties. Their origins go back beyond any recorded history.

During the 1000's and the 1100's in England, the king and a group of officials and noblemen traveled about the country, holding court. The officials who followed the king were called his *court*. The king was regarded as the source of justice, but he himself could not handle all the cases that were brought to him. Instead, he appointed some of the officers who accompanied him to hear cases and administer justice for him. These men were the early judges. Separate church courts handled cases involving members of the clergy and religious matters. See CANON LAW.

In the 1200's, a system of central courts became established in England. The king sent judges out into the country at regular intervals to hold court. The people recognized these as the king's courts, even though the king himself was not present. The earliest of the king's courts was the *Court of the Exchequer*, which collected the king's revenues. Next the *Court of Common Pleas* was set up. But at all times, cases were heard before the king himself, or, in Latin, *coram rege*. The king had advisers to help him decide these cases. Out of this grew the *Court of King's Bench*. The greatest court was Parliament, which is still known in Great Britain as the *High Court of Parliament*. The highest tribunal in Great Britain today is a committee of the House of Lords. Ranking below it are the *Court of Appeal*, *High Court of Justice*, and the county and borough courts.

The courts of the Exchequer, Common Pleas, and King's Bench continued in Great Britain until 1875, when they were consolidated in the High Court of Justice. The Court of Appeal was set up as an intermediate appellate court between the High Court and the House of Lords.

In America, provincial courts were set up in all 13 colonies. After the Revolutionary War in America, each state set up a court system modeled after the British courts.

ERWIN N. GRISWOLD

Related Articles. See the Government section of the various state, province, and country articles, such as CALIFORNIA (Government). See also CANADA, GOVERNMENT OF; UNITED STATES, GOVERNMENT OF THE. See also:

COURTS

Appellate Court
Court-Martial
Court of Appeals
Court of Claims
Court of Common Pleas
Court of Domestic Relations
Court of Military Appeals
Customs Court, United States
District Court
International Court of Justice
Juvenile Court
Parlement
Supreme Court of the United States
Territorial Courts

OFFICERS

Chief Justice
Clerk of Court
District Attorney
Judge
Jury and Trial by Jury
Justice of the Peace
Lawyer
Marshal
Notary Public
Public Defender
Puisne
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PROCEDURES AND WRITS

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OTHER RELATED ARTICLES

Constitution of the United States
Court Reporter
Crime
Justice, Department of
Kangaroo Court
Law Enforcement
Old Bailey
Star Chamber

COURT, in sports, is a flat, smooth surface for playing games. It is made of dirt, wood, cement, or other material, and usually has marked boundaries. Sports played in courts include racket games and basketball.

COURT-MARTIAL is a military court that tries persons accused of breaking the rules of conduct of the United States armed forces. These rules are set forth in the Uniform Code of Military Justice. The code provides for three types of courts-martial: (1) *general*, (2) *special*, and (3) *summary*.

A general court-martial consists of a military judge and a jury of at least five servicemen. General courts-martial may try a person for any military crime. But most of them deal with the most serious offenses, such as murder, mutiny, and spying.

A special court-martial includes at least three members, one of whom presides. It may rule on any offense except those punishable by death.

A summary court-martial consists of one officer. It tries enlisted men for minor offenses, such as short absences without leave. If a serviceman wants to be tried by more than one man, he may request a special or general court-martial instead of a summary trial.

Black Star

At a United States Army Court-Martial the president of the court reads its decision to the accused soldier and his lawyers.

In general and special courts-martial, defendants receive free counsel from officers who are lawyers. The defendant may also hire a civilian lawyer. Before a general court-martial assembles, a pretrial investigation decides if the charges are justified.

A commanding officer names a special or general court-martial for each case. Except in cases involving the death penalty, the defendant may request trial by a military judge alone. An enlisted man may ask that enlisted men make up at least a third of the court.

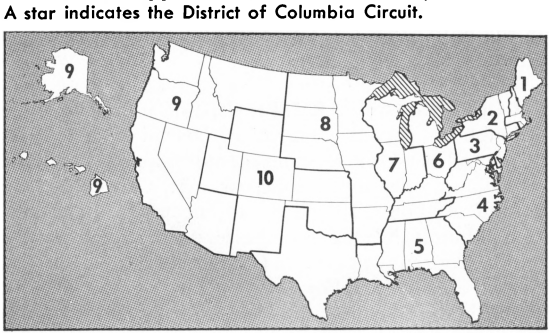
The officer who appoints a court-martial reviews its decisions. A legal officer of his staff must review all general court-martial cases. A court of military review examines each case involving a general or a flag officer and all cases involving such severe sentences as death or dismissal from the service. Any reviewer may reduce a sentence. The highest review body is the Court of Military Appeals. FREDERICK C. LOUGH

See also COURT OF MILITARY APPEALS; UNIFORM CODE OF MILITARY JUSTICE.

COURT OF APPEALS is a high federal or state court. The U.S. Court of Appeals ranks next to the Supreme Court of the United States as a reviewing authority. Several states also have courts of appeals.

The U.S. Court of Appeals hears most appeals from district courts and federal administrative agencies. It also reviews the decisions of some agencies. In some cases, the party who feels himself wronged has a right to appeal directly to the Supreme Court of the United States. In a few cases, the parties have a right to ask the Supreme Court to review a decision of a court of appeals. But in most cases, the Supreme Court only reviews cases that present an important question of law.

The Court of Appeals divides its work into 10 judicial circuits. A star indicates the District of Columbia Circuit.



COURT OF MILITARY APPEALS

In the early days in the United States, federal judges traveled from place to place to try cases and to hear appeals. The route which was assigned to the court was called the *circuit*. Today the circuits are geographical areas. Each circuit has one court of appeals.

The circuits are numbered one through ten. The eleventh circuit covers only the District of Columbia. The First Circuit includes Puerto Rico, the Third includes the Virgin Islands, the Fifth includes the Panama Canal Zone, and the Ninth includes Alaska and Hawaii. The judges of the First, Fifth, and Ninth Circuits travel to these places to hear cases.

Only three judges ordinarily sit to decide each case, although more than three judges are assigned to some circuits. A justice of the Supreme Court is assigned to each circuit as the *Circuit Justice*. In early times, he often helped decide cases at the court of appeals level, but now he rarely does this. The chief judge has a position on the court of appeals like that of the chief justice of the Supreme Court. The chief judge assigns tasks to the other judges. ERWIN N. GRISWOLD

See also CIRCUIT RIDER; COURT (Federal Courts); DISTRICT COURT; SUPREME COURT OF THE UNITED STATES.

COURT OF CHANCERY. See EQUITY.

COURT OF CLAIMS is a special court which settles claims against a state or government. Congress created the United States Court of Claims in 1855. The court has a chief justice and four judges appointed by the President. Usually no one can sue the U.S. government without its consent. But the government agreed to be sued on certain claims when this court was established. Congress appropriates money to pay for judgments of this court. See also CLAIM. ERWIN N. GRISWOLD

COURT OF COMMON PLEAS was a court in England in which civil cases were heard. The courts were probably first set up in the 1200's. Cases brought by common citizens were called *common pleas*. This distinguished them from cases brought by the government, which were called *pleas of the crown*. The Court of Common Pleas existed until 1875, and then its duties were assigned to the High Court of Justice. ERWIN N. GRISWOLD

COURT OF DOMESTIC RELATIONS is a special court which deals with problems of the family. Its procedure is less formal than that of most courts and is often much like that of a court of equity, although it may also have the powers of a criminal court in some cases. The matters handled by the court differ from place to place but may include action for divorce, nonsupport of wife or child, adoption, guardianship, and crimes against children. Sometimes the court handles cases dealing with neglected or delinquent children. JOHN W. WADE

See also EQUITY; JUVENILE COURT.

COURT OF EQUITY. See EQUITY.

COURT OF MILITARY APPEALS is the highest appeals court of the U.S. armed forces. It consists of three civilian judges appointed by the President. The court reviews all court-martial verdicts that provide for the death sentence or involve general or flag officers. A serviceman may appeal to the court after a board of military review has examined the court-martial findings. The chief legal officer of the Army, Navy, or Air Force may ask the court to review other court-martial cases. See also COURT-MARTIAL. FREDERICK C. LOUGH

COURT PLASTER

COURT PLASTER is thin silk treated with a solution of isinglass, alcohol, glycerin, and water. At one time it was used to cover skin cuts and blemishes. Now, cosmetics or sterile adhesive bandages are used. The term comes from the old custom of ladies at court wearing specks of black plaster on the face. AUSTIN SMITH

COURT REPORTER is a stenographer who records the testimony given at a trial or other legal proceeding. He records every word spoken except discussions that the judge or attorneys indicate should be "off the record." If testimony is given that may not be admitted as evidence, the judge can instruct the court reporter to "strike that from the record." Court reporters take notes in shorthand or on a machine, and later transfer them to a typewritten record. Newspaper reporters who cover court news are often called *court reporters.*

COURTESY. See ETIQUETTE.

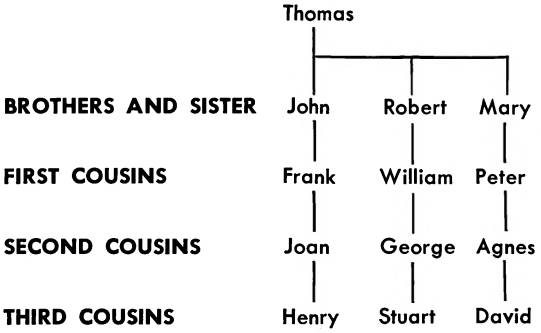
COURTOIS, *KOOR TWA,* **BERNARD** (1777-1838), a French chemist, discovered the element iodine in 1811. He obtained violet vapors by adding sulfuric acid to the ashes of seaweed. The vapors condensed to form black crystals. Sir Humphry Davy named the element iodine. Courtois was born in Dijon, France. PAUL R. FREY

COURTSHIP OF MILES STANDISH, THE, is a long narrative poem by Henry Wadsworth Longfellow about the Pilgrims of Plymouth Colony. It tells how Captain Miles Standish courted Priscilla Mullens, "the Mayflower of Plymouth." Standish lacked the courage to ask Priscilla to marry him. He persuaded his friend, the young and handsome John Alden, to tell her of his offer. John himself loved Priscilla. But he was a loyal friend of the captain, so he carried out the mission.

The story is based on tradition rather than known facts. One of the descendants of John Alden published a prose version (1812-1814). This version tells that John soon visited Priscilla again on his own behalf, and that later they were married. Standish was supposed never to have forgiven his friend. But the poem relates that he went to fight the Indians, and returned on the wedding day to wish the bride joy. NORMAN FOERSTER

See also ALDEN (John); PLYMOUTH COLONY; STANDISH, MILES.

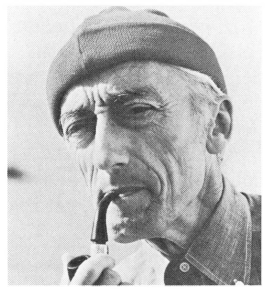
COUSIN is a person outside your immediate family related to you by blood and descended from the same ancestor. The chart shows how cousins are related.



First cousins are children of brothers and sisters, so Frank, William, and Peter are first cousins to each other. *Second cousins* are children of first cousins, so Joan, George, and Agnes are second cousins, and so on. A *first cousin once removed* is the child of your first cousin, so George and Agnes are Frank's first cousins once removed. Henry and Stuart are Peter's first cousins twice removed, and so on. See also FAMILY (Family Relationships).

COUSTEAU, *koo STOH,* **JACQUES-YVES,** *zhahk eev* (1910-), is a French oceanographer, author, and motion-picture producer. He developed many techniques for undersea exploration. In 1943, Cousteau helped invent the *aqualung.* This breathing device enables a diver to move about freely under water for long periods of time. Cousteau also developed the first underwater diving station and an underwater observation vehicle called the *diving saucer.*

Since 1951, Cousteau has explored the world's oceans with his research ship *Calypso.* He has written several books about sea life that have been translated into many languages. These books include *The Silent World* (1953), *The Living Sea* (1962), and *World Without Sun* (1964). He also has produced many films about sea life, three of which won Academy Awards.


Courtesy of Doubleday
Jacques-Yves Cousteau

In 1960, Cousteau and Prince Rainier III of Monaco opposed France's plan to dump radioactive wastes into the Mediterranean Sea. France abandoned the plan that same year. During the 1960's and 1970's, Cousteau's television series, "The Undersea World of Jacques Cousteau," dramatized underwater exploration and the need for conservation of ocean life. Cousteau was born in St.-André-de-Cubzac, near Bordeaux. JOHN A. WIENS

COUSY, BOB (1928-), ranks among the outstanding all-around players in basketball history. Cousy played guard for the Boston Celtics of the National Basketball Association (NBA) from the 1950-1951 season through the 1962-1963 season. He helped lead the Celtics to six NBA championships. Cousy won fame for his skillful dribbling and accurate passing. He led the league in *assists* (passes to teammates that result in scores) every season from the 1952-1953 season through the 1959-1960 season. Also a fine shooter, Cousy averaged 18½ points per game during his career.

Robert Joseph Cousy was born in New York City. He won All-America honors at College of the Holy Cross in 1950. From 1963 to 1969, he was basketball coach at Boston College. From 1969 to 1973, he coached the Cincinnati Royals (now the Kansas City-Omaha Kings) in the NBA. In 1974, he became commissioner of the American Soccer League. HERMAN WEISKOPF

COUVADE. See FAMILY (The Couvade).

COUZENS, JAMES JOSEPH (1872-1936), a Michigan Republican, served as mayor of Detroit from 1919 to 1922, and as a United States senator from 1922 to 1936. A philanthropist and public reformer, Couzens set up a fund of about $10 million to encourage better care of children in Michigan and elsewhere throughout the world. Couzens was born in Chatham, Ont. In 1903, he helped organize the Ford Motor Company. He became its business manager and vice-president. SIDNEY GLAZER

COVARRUBIAS, *koh vahr ROO byahs*, **MIGUEL,** *mee ghel* (1904-1957), a Mexican painter, became internationally known for his caricatures of famous persons. His paintings of Negro, Mexican, and Balinese types revealed a keen appreciation of the characteristics of peoples of various lands, and are documents in ethnology and anthropology, as well as in art. His map murals of Pacific regions also are famous.

Covarrubias' works include *The Prince of Wales and Other Famous Americans* (caricatures, 1925), *Negro Drawings* (1927), *The Island of Bali* (1937), *Mexico South* (1946), and *Indian Art of Mexico and Central America* (1957).

Covarrubias was born in Mexico City, and was largely self-taught as an artist. NORMAN L. RICE

COVENANT. See JUDAISM (Service to God).

COVENANT, ARK OF THE. See ARK OF THE COVENANT.

COVENANT COLLEGE. See UNIVERSITIES AND COLLEGES (table).

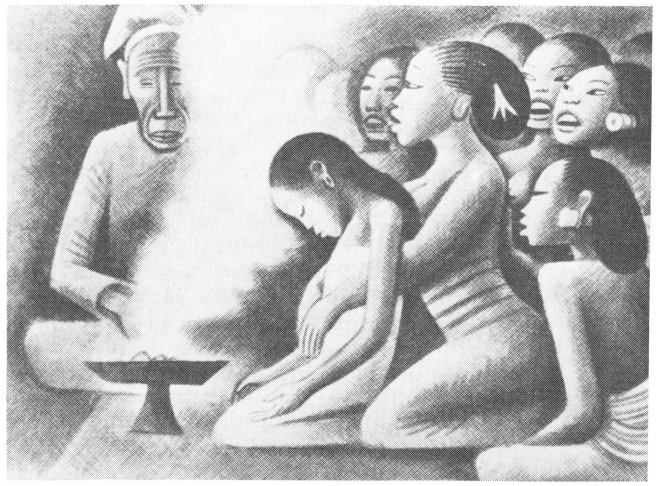
COVENANTERS, *KUHV uh nuhn tuhrz*, was the name given to members of a religious group in Scotland. They bound themselves by a series of agreements, or covenants, to uphold the Presbyterian faith. The most important of the early covenants was drawn up in 1580. At this time, Roman Catholics were making a serious effort to regain Scotland for their church. The *National Covenant* of 1638 was a revival of this agreement. It was adopted and signed at Edinburgh as a result of the efforts of King Charles I and Archbishop Laud to force the Scots to accept English forms of worship.

The Solemn League and Covenant of 1643 was practically a treaty between England and Scotland. It was signed by the General Assembly of the Church of Scotland and by the commissioners of the English Parliament. It established the Presbyterian Church in England, Scotland, and Ireland. Charles II later rejected both of these covenants. W. M. SOUTHGATE

COVENTRY, *KAHV uhn tree* (pop. 335,410), is an automobile and industrial city in England. It lies in Warwickshire (see GREAT BRITAIN [political map]). The city appears often in old legends. Lady Godiva and her husband are supposed to have founded a Benedictine monastery there on the ruins of a convent built in the 800's and destroyed by the Danes in 1016. Coventry once had many buildings of historic interest, including three churches whose spires could be seen from a distance. During World War II, most of the center of the city was destroyed by a German air raid. Dedication of Coventry's new cathedral in 1962 climaxed the rebuilding of the city. JOHN W. WEBB

See also ENGLAND (picture).

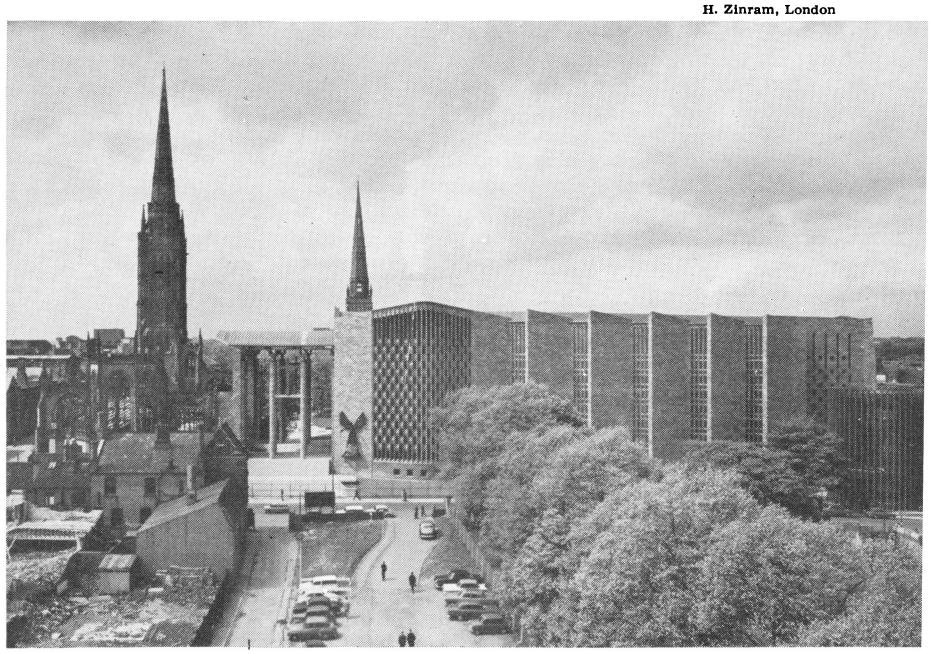
COVERDALE, MILES (1488?-1568), a bishop of Exeter, England, became famous for his English translation of the Bible in 1535. He used Tyndale's English version of the New Testament and the Old Testament through



From *The Island of Bali* by Miguel Covarrubias, © 1936, 1937 Alfred A. Knopf, Inc.

Miguel Covarrubias painted in flat, decorative, almost poster-like patterns in the illustrations for his book *The Island of Bali.*

H. Zinram, London



Coventry Cathedral rises near the ruins of the old church, *left*, which is kept as a memorial. The modern cathedral was completed in 1962 at a cost of more than $4 million. The old church, built in the 1300's, was destroyed by a Nazi air raid in 1940.

Chronicles. He translated other portions from the Latin and from Martin Luther's German translation. Coverdale also helped produce the Bible of Cromwell, or *Great Bible*, and edited Cranmer's Bible. He was born in Yorkshire, and educated at Cambridge. GEORGE L. MOSSE

See also BIBLE (The Bible in Modern Tongues).

COVERED BRIDGE. See NEW BRUNSWICK (Places to Visit); INDIANA (color picture); OHIO (color picture).

COVERED WAGON. See CONESTOGA WAGON; PIONEER LIFE IN AMERICA (Crossing the Plains).

COVERT, *KUV ert*, is a cloth woven with raised lines that run diagonally across the surface of the fabric. The yarns of covert cloth are often woven in white and in color to give it a speckled appearance. Cotton covert, 35 inches (89 centimeters) wide, is used to make suits, trousers, and play clothes. Wool covert, 54 inches (137 centimeters) wide, is used in making such items as coats, suits, riding habits, and raincoats.

COVINGTON, Ky. (pop. 52,535), an industrial center, is the third largest city in the state. It lies at the junction of the Ohio and Licking rivers, across the Ohio River from Cincinnati, Ohio. For location, see KENTUCKY (political map).

Covington's most important manufactures include iron and steel products, machine tools, packaging machines, electric equipment, time locks, parking meters, paper products, bags, asphalt, lithograph and art products, and lumber products. Other important industries include meat packing, brewing, distilling, and fruit packing. Covington has one of the world's largest X-ray equipment laboratories. Greater Cincinnati Airport lies outside Covington. Two railroad freight lines, Ohio River barge lines, and highways also serve the city.

Covington was incorporated in 1815, and named after General Leonard Covington, a hero of the War of 1812. It has a council-manager government. THOMAS D. CLARK

COW is a female adult animal of the bovine group. The term *cow* is also used for the female of other mammals, including moose and seals. Cows, bulls, and steers are called *cattle* (see CATTLE).

COW PARSNIP is a large, coarse plant which belongs to the parsley family. It grows from 4 to 8 feet (1.2 to 2.4 meters) high and has large, hairy leaves. Its small white flowers grow in huge clusters. The plant becomes a troublesome weed when allowed to grow in damp soil near water. The cow parsnip may be eaten in place of celery, but is usually used as fodder.

Scientific Classification. The cow parsnip belongs to the parsley family, *Umbelliferae*. It is classified as genus *Heracleum*, species *H. maximum*.

HAROLD NORMAN MOLDENKE

Sir Noel Coward

Larry Fried, Pix

COWARD, SIR NOEL (1899-1973), gained distinction as an actor, playwright, director, and composer for the stage and motion pictures. He became best known for his sparkling dialogue in such comedies as *Hay Fever* (1925), *Private Lives* (1930), *Tonight at 8:30* (1935), and *Blithe Spirit* (1941). His songs include "Some Day I'll Find You" and "I'll See You Again." He wrote two autobiographical books, *Present Indicative* (1937) and *Future Indefinite* (1954). His novel *Pomp and Circumstance* appeared in 1960.

Coward was born in Teddington, England. His first success as a writer came with *The Vortex* in 1924. His acting and singing were limited mainly to the leading roles in his own plays and revues. He was knighted in 1970. RICHARD MOODY

COWBIRD is a migratory North American bird. It is a kind of blackbird. It makes its home from Mexico as far north as southern Canada. Its full name is the *brown-headed cowbird.*

Cowbirds lay their eggs in the nests of other birds and leave the youngsters for the foster parents to raise. The female cowbird chooses a nest that belongs to some small bird, and usually lays only one egg in it while the other birds are away. Then she flies off and does not return. The young cowbird is much larger than the other young birds in the nest, and generally grabs most of the food. As a result, the other youngsters sometimes starve. The foster parents do not seem to realize that they are raising an outsider. But if the egg is discovered, especially when placed in the nest of a yellow warbler, the other bird covers it and builds another nest on top of the old one. Cowbird eggs are white with brownish specks.

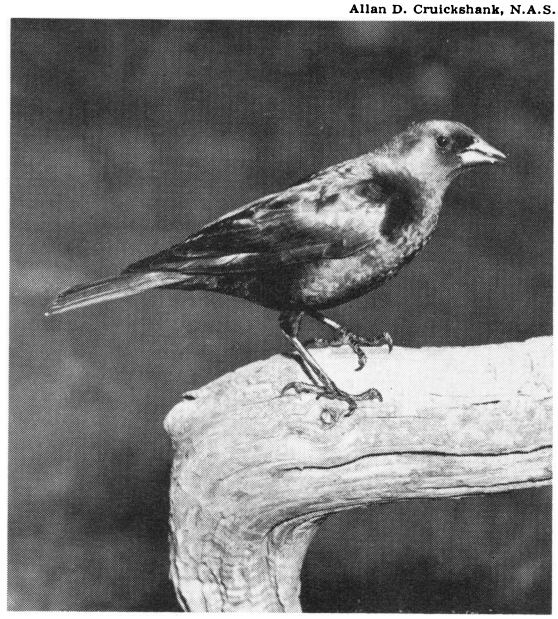
The male cowbird is about 8 inches (20 centimeters) long, and is seen more often than the smaller female. It has shining black feathers and a brown head. The female has a dull, brownish-gray color. Cowbirds feed on insects, worms, seeds, and berries. The cowbird's call is a shrill, grating whistle, sometimes followed by a few sharp notes.

Scientific Classification. The brown-headed cowbird belongs to the icterid family, *Icteridae*. It is genus *Molothrus*, species *M. ater*. ALBERT WOLFSON

See also BIRD (Foster Parents; picture: Bird Nests).

The Cowbird lays its eggs in other birds' nests, then lets the foster parents hatch them and feed and care for the young.

Allan D. Cruickshank, N.A.S.



COWBOY

Ewing Galloway

The American Cowboy has always been a symbol of the strength and vigor of the colorful "Wild West."

COWBOY. Men who take care of large herds of cattle are called *cowboys* or *cowhands*. American cowboys gained fame in the days of the western frontier. The dangerous lives they led, the sad songs they sang, and the colorful vocabulary they used have all become a part of American folklore.

Cowboys are known by various other names. Early cowboys were called *cowpokes* or *cowpunchers*, because they used sticks to poke cattle onto loading ramps. *Wranglers* are cowboys who look after the horses on a ranch. Mexicans call a cowboy a *vaquero*, and this name has become *buckaroo* in English. The South American name for cowboy is *gaucho*. Many cowboys today prefer to be called *cowhands*, because they are hired *hands*, or workers, who tend cows. Cowboys usually call all cattle *cows*, regardless of whether the animals are young or old, steers or cows.

Western cowboys became important in the late 1860's after the Civil War. They worked on ranches in Texas, Montana, and other Western States. They spent long, hard weeks driving cattle from the ranches to railroad towns where the cattle were shipped east. Many cowboy songs and tales originated on these "long drives" along western trails.

There have probably never been more than about 100,000 cowboys. But their lonely jobs, their difficult work, and their part in building the West have given cowboys an importance far beyond their numbers.

For a description of cowboy life today, see RANCHING.

A Cowboy's Equipment

His Horse was a cowboy's most precious possession in frontier days. It was his only means of transportation. On the trails, a sure-footed horse might mean the difference between life and death for a cowhand. If a herd stampeded, the cowboy depended on his horse to help *head* the cattle (get them under control). A horse was so valuable that a cowboy might give all the water in his canteen to his horse, even if it meant that he himself had to go thirsty.

All cowboys had to be good horsemen, because they actually "lived in the saddle." Cowhands must still be able to ride well. Almost every cowboy owned a horse of his own, and possibly a spare one. But, on the ranch, he might have about six horses for his own use. These horses belonged to the ranch owner, who assigned them to the cowboys. No cowboy was allowed to ride a horse assigned to another man. A day on the trail might involve so much work that a horse often needed several days to recover. Most cowboys saved their best horses for night work, because neither horse nor rider could afford to make mistakes in the darkness.

A horse wrangler kept ranch horses together. He made sure that the right horse was ready when a cowboy needed it. Cowboys on a ranch sometimes held *horse roundups* to count their horses. At one time or another, most cowboys took turns at *breaking* (taming) wild horses. But younger cowboys usually did most of the breaking. Montana cowboys were known as the best "bronc busters."

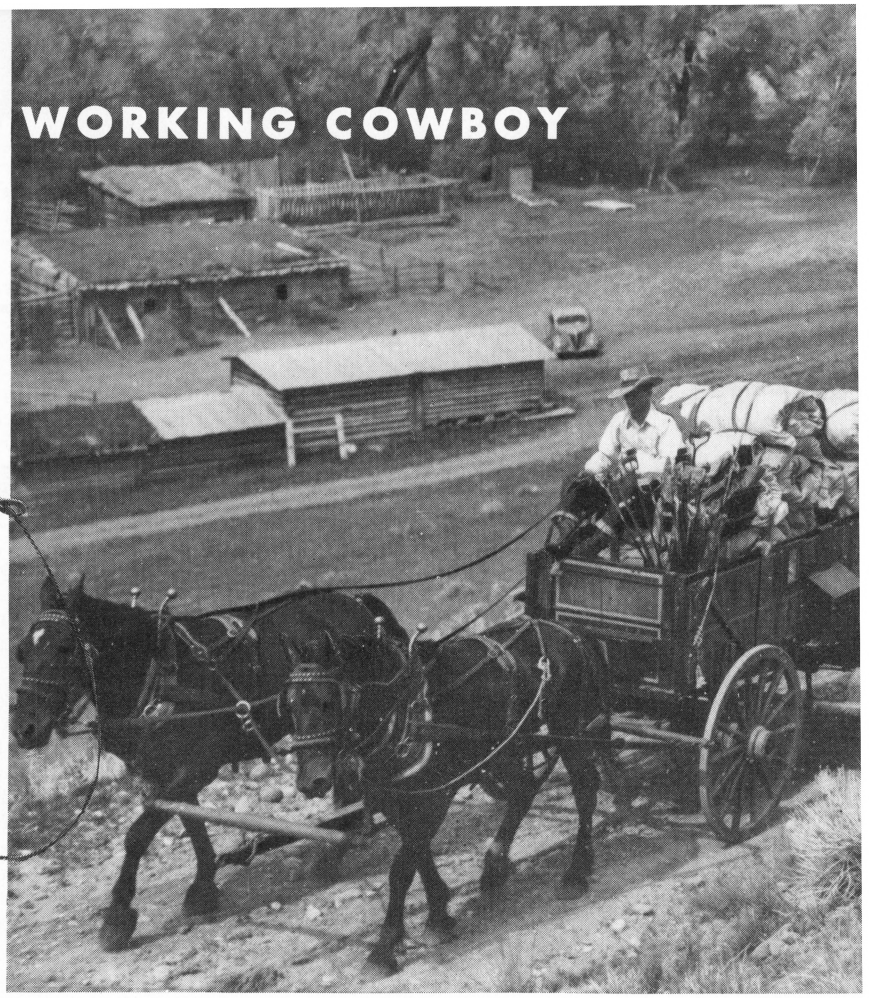
Cowhands still use heavier and larger equipment than horsemen in the East. A Western saddle is large and roomy. It has a sturdy *pommel* (horn) that the cowboy can lash his rope to or hold on to when necessary. The *cantle* (back of the saddle) curves up to give the rider better support. A cowhand can even take short naps in his saddle without fear of falling off. He can also use his saddle as a pillow when he stretches on the ground. See SADDLE.

The early Spanish explorers brought the horse to North America. Some of their horses broke loose and ran wild on the western plains. Gradually, the Indians captured horses and learned to use them for their fast hit-and-run attacks on each other and on white men. Mexican vaqueros began to tend cattle from horseback. When the American cowboy came along, he learned to use the horse as an aid both in fighting and in handling cattle. Wild horses usually ran in packs, like wolves, ready to be taken by anyone smart enough and fast enough to catch and tame them. The earliest horse used was the *mustang*, which originally came from Arabia. Mustangs were smaller than average horses, but had greater endurance. They also had what the cowboys called "cow sense" in directing and searching out the cattle. See HORSE (color pictures).

His Clothing evolved from practical needs, and has changed little since early days. The cowboy started

THE WORKING COWBOY

Union Pacific



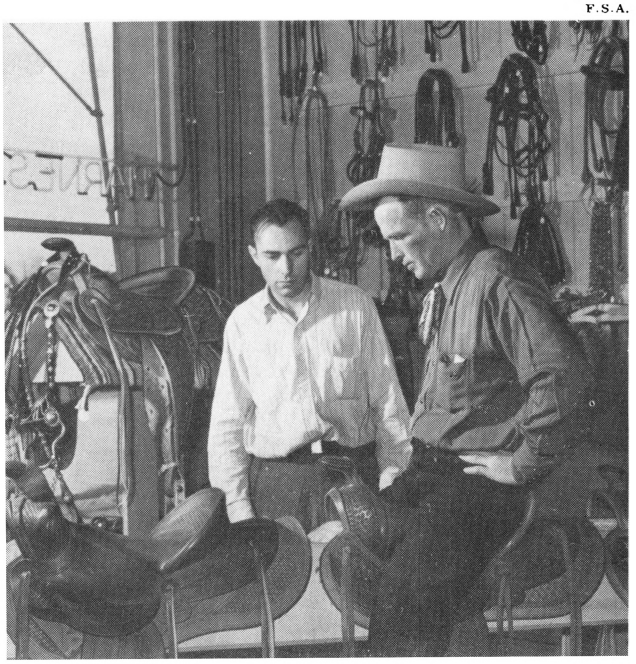
Charles J. Belden

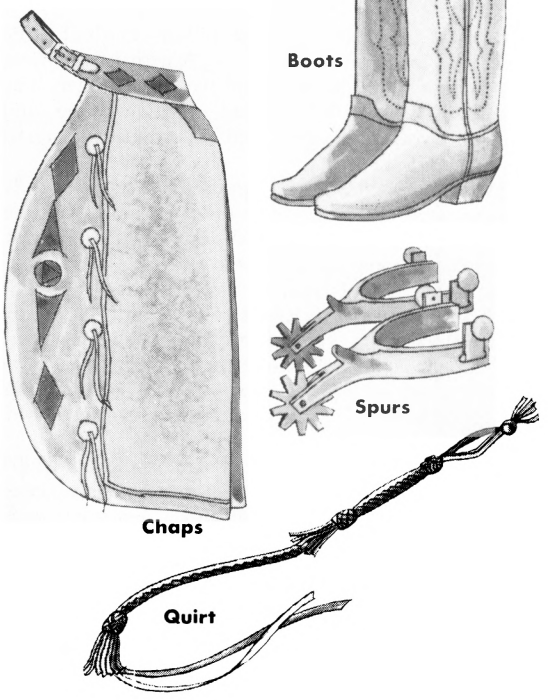
A Good Horse and a Strong Rope have long been regarded as the two things a cowboy must have for his work.

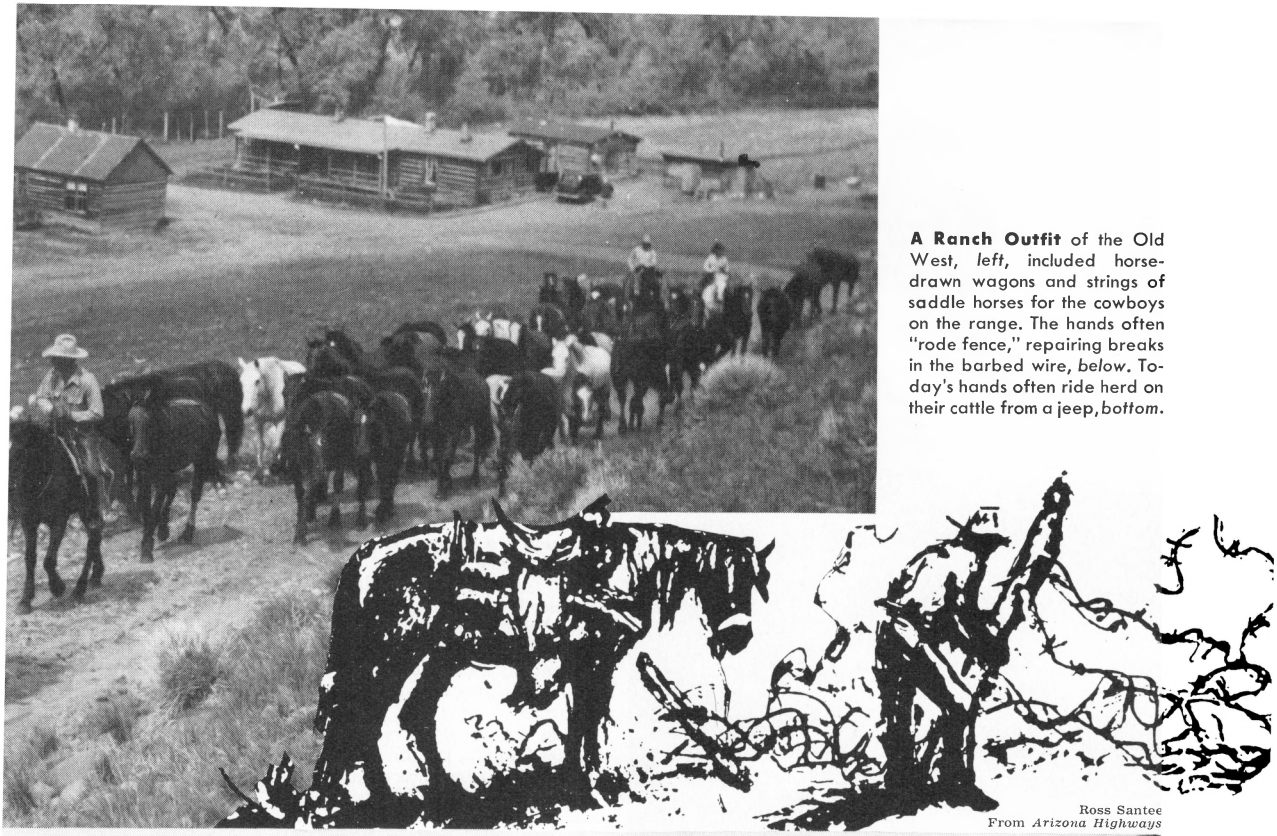
The Cowboy's Equipment, *below,* includes boots and chaps, to protect his legs and feet, and spurs and quirt, to control his horse.

Saddles represent a major investment, and each cowhand picks his with great care. The hands no longer "live in the saddle," but they still need strong, well-made saddles and harnesses.

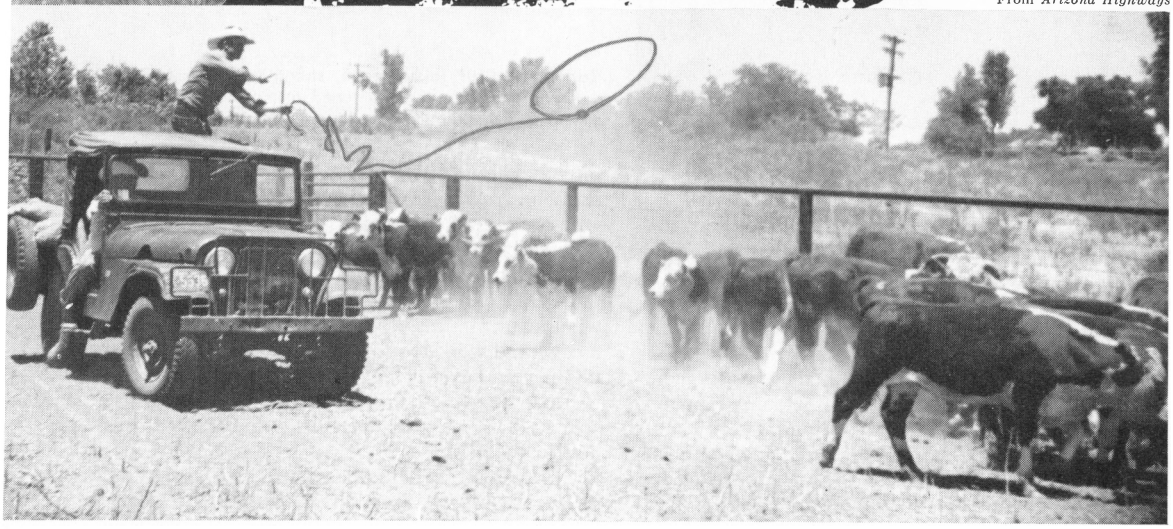
F.S.A.







Ross Santee
From *Arizona Highways*



Look Magazine

A Ranch Outfit of the Old West, *left*, included horse-drawn wagons and strings of saddle horses for the cowboys on the range. The hands often "rode fence," repairing breaks in the barbed wire, *below*. Today's hands often ride herd on their cattle from a jeep, *bottom*.

wearing his trousers tight because he did not want loose cloth flapping or catching brush as he chased cattle. His trousers are still called *Levi's*. He began wearing leather *chaps* to keep thorns and branches from tearing his trousers, and to protect his legs from rubbing during the long hours he spends in the saddle. His broad-brimmed *sombrero* (hat) was designed to keep the sun and wind out of his eyes, and to have enough brim to catch water in the rain. The hat's deep crown helped keep it on the cowboy's head when he rode madly after a stampeding herd. It could also be used as a bucket. A sombrero was made large enough and sturdy enough to serve as a sort of whip. The cowboy could wave it to direct a surging herd of cattle, to urge his horse on, or to send signals to his companions a couple of hills away.

The cowboy's high-heeled boots also began for practical reasons. The heel gave him a hold in the stirrup. The length of the boot supported his ankles and provided warmth. A cowboy's neckerchief or bandana could be pulled over his face as a filter against dust.

An early cowboy's equipment always included a knife and a gun. The knife served a variety of purposes, from mending bridles to spearing a piece of hot *chuck* (food). The pistol was usually a Colt revolver with about a seven-inch barrel (see REVOLVER). The cowboy used it to frighten cattle and make them move, and to defend the herd from bandits. Some cowboys carried Winchester rifles. The rifles had better range and accuracy,

"Dick" Whittington

Roping a Calf takes speed, strength, and skill. The cowhand must hold the frightened animal down until he can tie its legs. Roping is a favorite display at rodeos.

COWBOY TERMS

Bronco is a wild horse.
Chuck is food.
Cinch is a band that goes around a horse's body to hold a saddle or a pack.
Dogie is a calf whose mother has left it.
Hackamore is a halter.
Kidney Pad refers to a small saddle used by Easterners.
Maverick is an unbranded cow whose owner is unknown.
Muley is a hornless cow. Cowboys do not like to herd muleys.
Mustang means any wild horse.
Necktie Social was a hanging in early days.
Nester was a squatter who settled on government land, usually to farm.
On the Dodge means hiding from the police.
Outlaw is any animal that is particularly wild. The term may also be used for a criminal.
Paint is a horse with irregular patches of white.
Quirt is a cowboy's whip.
Remuda is a range outfit's collection of saddle horses. No mares are permitted in a remuda.
Road Agent is cowboy slang for a robber.
Rustler is a cattle thief.
Shindig is a cowboy dance.
Sold His Saddle. If a man has "sold his saddle," it means that he is disgraced.
Stetson is any cowboy hat, regardless of the manufacturer.
String is a cowboy's *mount*, or line, of horses.
Tenderfoot is a person who is new to a job.
Waddy is a temporary hand hired when a ranch is short of help.

but were bulkier and less handy. The knife is still useful, and, in wilder areas, cowhands still carry guns.

His Rope was an early cowboy's most important tool. He used it to catch cattle, to hold his horse, to pull his wagons across muddy rivers and swamps, to tie his packs in place, and to kill snakes. As Ramon F. Adams said in his book *Western Words*, the cowboy "does everything with his rope except eat with it."

Early ropes were made of horsehair, grass, or henequen. Most ropes today are made of nylon. A rope may be from 30 to 70 feet (9 to 21 meters) long. It has a small *honda knot*, or fixed loop, at one end. The cowboy passes the other end of the rope through this knot to form a loop. Then he can pull the rope tight or slack it off after he has caught an animal. Cowboys in the Southwest use the word *lariat* (from the Spanish *la reata*, meaning *the rope*). Pacific Coast cowboys sometimes use the word *lasso* to mean *to rope*. See KNOTS, HITCHES, AND SPLICES.

The Life of a Cowboy

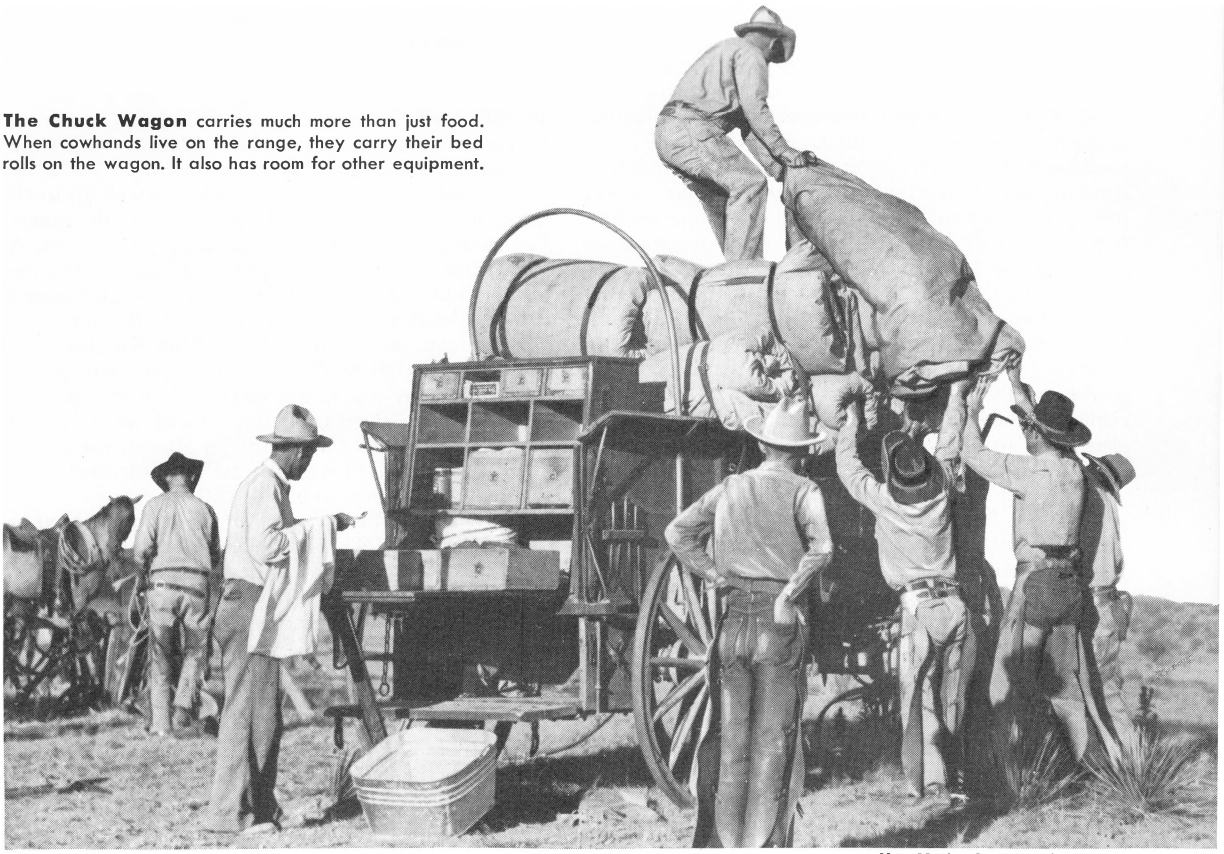
Cowboys often live lonely lives. Most ranches lie far from even the smallest towns. A cowhand may go for months without seeing anyone besides the dozen or so men with whom he works. Early cowhands labored long hours, especially on the trail. They always suffered from lack of sleep, and often from broken bones caused by spills from a horse.

On the Ranch, the cowboy of early days served as an odd-job man, doing whatever was necessary. He might pitch hay, hunt stray animals, clear brush, break horses, or mend *gear*, or equipment. He lived in a bunkhouse with the other hands, apart from the main house, where the ranch owner lived. The cowboy's main job was to watch and protect the cattle as they grazed on the range. He often *rode fence*, or patrolled the range to see whether any fences needed repairing. Even today, when a cowhand works out on the range, he camps wherever night overtakes him. He spreads his bedroll on the ground to sleep in. A cowboy always sleeps with "one ear cocked," listening for any unusual activity or restlessness in the herd.

Cowboys ate a limited variety of food, including fresh beef, salted pork and bacon, beans, and sourdough biscuits. A ranch cook, or *cookie*, prepared the food and rode the range with a *chuck wagon* (see CHUCK WAGON). The men ate from tin plates while sitting on the ground, resting on rocks, or standing. They drank coffee from tin cups or cans. They ate few fresh fruits, and drank little fresh milk. This still holds true in many areas.

Most cowboys spent their spare time talking, playing cards, reading, or just being bored. On the trail, they were usually too tired at night to do more than swap a few tall tales or play some practical joke. On the rare occasions when a cowboy did leave the ranch and go to town, he visited a barber, shopped, and talked with other cowboys. On the whole, in spite of motion-picture attitudes, most cowboys behaved as well as any other people who had been away from civilization for months.

The Roundup is a business period when a ranch owner



The Chuck Wagon carries much more than just food. When cowhands live on the range, they carry their bed rolls on the wagon. It also has room for other equipment.

New Mexico State Tourist Bureau

gets an accurate idea of how many cattle he actually owns. In early days, cattle from various ranches in an area grazed together on the great open range. Twice a year, cowboys rounded up the cattle, and herded them to a central place. Men from each ranch sorted out their own cattle according to the animals' markings. Then they *branded*, or marked, new calves, selected older cattle to go to market, and separated diseased or undersized animals from the regular herd. Roundups occupied an important place in a cowboy's life. They required more skill than any other phase of his work. As a result, there was a certain rivalry about a roundup, somewhat like that of an athletic contest.

A roundup was also a social event. As many as 10 ranches might be represented at a single roundup. That would mean visiting with old friends as well as working. On northern ranges, as in Montana and Wyoming, roundups might attract as many as 300 cowboys. The cowboys often held a large celebration called a *rodeo* after they finished their work (see RODEO). They competed in bareback riding, steer wrestling, calf roping, and other tests of skill. Rodeos are popular today, but are more commercialized.

Branding Cattle was an early means of reducing the chance of their being lost or stolen. Each ranch still has its own *brand*, or scar design, placed in a certain position on all its cattle. Cattle owners register their brands with county or state authorities. For example, a brand may be described as a *clover leaf* placed *right side, flank;* or the letter *R* placed *left side, jaw*. Brands are respected throughout the West. In early days, a calf could wander off the range in Texas and travel all the way to Montana. Anyone who found the calf in Montana would check to see whose brand it bore. He would then arrange to return the calf to its owner. Sometimes a dishonest cowboy would try to change the brand on a stray cow to make it appear that the stray wore his brand. But if a thief were caught tampering with another man's brand, he usually met swift and stern justice.

Branding is an important feature of a roundup. After the cattle from each ranch have been herded into a *corral*, or enclosed yard, the cowboys ride among them to select new calves to be branded. This process is called *cutting out*. Both horse and rider need great skill to isolate a lone calf from a milling herd. Once a calf has been cut out, the men drive or drag it to a fire. A number of branding irons are kept red-hot in the flames. Some of the men drag the animal into position by the fire, and others apply one of the branding irons to its side. The resulting burn leaves a permanent scar in the animal's flesh. One man keeps *tally*, or scores the number of animals branded by each outfit.

Cowhands sometimes make other markings and clips on their cattle in order to recognize them easily. The most common markings are knife cuts on the animal's ears or on its *dewlap*, the skin under its neck. Each ranch has its own mark registered with the proper agency. Old-time ranch owners branded their horses, but most horses were not marked.

The Cattle Drive. Perhaps the most tiring work of an

early cowboy was trailing a herd from the range to market. This "long drive" might mean moving hundreds of cattle over a great distance. The cattle plodded along with riders ahead, behind, and on both sides. The cowboys had to be able to get the herd across rivers, find watering places for it, guard it against Indian attack, protect it in bad weather, and head off stampedes that might scatter the cattle. Cowboys often sang songs to pass away the hours. A man on night watch would enjoy crooning softly to the herd. No matter how poor the cowboy's voice, it seemed to have a soothing effect on the cattle.

At the end of the trail lay the "cow town," where the cowboys delivered their herds. Most cow towns had a cemetery called *Boot Hill*. These Boot Hill cemeteries were filled with cowboys who had played a little too hard in the cow towns, and wound up getting shot.

History

The name *cowboy* goes back to the Revolutionary War in America, but it has little to do with the cowboys of today. The first "cowboys" were Tories, or Americans who were loyal to England. They were called cowboys because they often lured American patriots into traps in the brush by tinkling cowbells as if they were lost cattle. These men operated in Westchester County, near New York City. Later, the name cowboy came to be used only for cowhands who tended cattle in the West.

Beginnings. Cattle raising became an important industry in the United States in the late 1860's. Ranchers in Texas raised Longhorn steers that they sold in the East at a profit. Cowboys trailed herds to railroad towns where dealers shipped the cattle to Chicago and other meat-packing centers. Ranchers found that trailing the herds was a cheap way of transporting them to the railroads. In addition, the cattle usually fattened along the trails. Cowboys often used the Chisholm Trail, which ran from the Mexican border through Austin and Waco, Tex., to Abilene, Kans. Some favored the Western Trail, which led to Dodge City, Kans., still called "the cowboy capital of the world." The Shawnee Trail ran east to Kansas City and St. Louis, Mo. See ABILENE; DODGE CITY.

During the 1870's and 1880's, more and more cattlemen began driving herds north to be sold for beef. They also drove cattle into such northern areas as Montana, Wyoming, and the Dakotas, to stock the ranges there. These ranges had been left open to grazing when buffalo herds were destroyed and Indian tribes were placed on reservations. Some cattlemen bought cattle in Texas and drove them west to California and Arizona. But most California cattle came directly from Mexico.

Cattlemen could make large profits during the 30 years after the Civil War. A steer that cost $5 in Texas or Wyoming would be worth about $40 to $50 in Chicago. The cattle industry enjoyed a boom, and some cattlemen made huge fortunes (see WESTERN FRONTIER LIFE [The Cattle Boom]). The boom had for the most part ended by the middle of the 1880's. But while it lasted, it advertised the cattle industry and brought fame to the cowboy who tended the herds. Cattle raising became more of a regular business in the 1900's. With the growth of railroads and the closing of the trails, cowboy life lost much of its color, glamor, and adventure.

Cowhands Today differ in two ways from earlier cowboys. First, they have more specialized jobs. They can do some particular types of work better than cowboys of the 1880's. But most of them are not so experienced in all-round work. Second, today's cowboys on large ranches generally use machines for many jobs that earlier cowboys had to do themselves. A pick-up truck carries cowboys from ranch headquarters to the range. Trucks move the cattle from one range to the next. A special truck delivers food that is fresh and hot to cowboys working on the range. Helicopters search through the thick brush for stray cattle. Machines dig ditches or holes for fence posts. The use of machines has also given cowboys more leisure time than they ever had before.

But in many ways, the cowhand's work has not changed much since early days. Cowboys must still know how to ride. They must be able to work long hours, in all kinds of weather, and on little food. And they must know how to handle cattle.

The National Cowboy Hall of Fame was opened in Oklahoma City, Okla., in 1965. It honors outstanding Americans who had a part in developing the West. The hall is sponsored by the 17 Western States. It includes an art gallery for Western photographs and paintings, and a shrine. Each of the Western States has a section in the shrine to honor its heroes. A large research library of Western history opened in 1968. About 140 persons have been elected to the Hall of Fame, including Will Rogers, the Oklahoma humorist; Theodore Roosevelt, President of the United States, who was a rancher in the Dakotas during his early life; Charles Russell, a Montana artist who painted many scenes from cowboy life; James McClure, a New Mexico rancher and rodeo official; and Charles Goodnight, a pioneer cattleman of Texas, who founded the Goodnight Trail. JOE B. FRANTZ

Related Articles in WORLD BOOK include:

Bronco
Chuck Wagon
Gaucho
Hawaii (picture: Hawaiian Cowboys)
Horse
Indian Wars
Oklahoma (picture: *The Cowboy*)
Oregon (picture: Branding Cattle)
Ranching
Rodeo
Rogers, Will
Roosevelt, Theodore
Saddle
Texas (pictures)
Western Frontier Life
Westward Movement

Outline

I. A Cowboy's Equipment
A. His Horse B. His Clothing C. His Rope
II. The Life of a Cowboy
A. On the Ranch
B. The Roundup
C. Branding Cattle
D. The Cattle Drive
III. History

Questions

What are some items of a cowboy's clothing? What purposes do they serve?

What is (1) a chuck wagon? (2) a cowpuncher? (3) a "cow town"?

What kind of work did early cowboys do on the ranch? On the range?

What was the "long drive"? Why was it important?

Why do ranchers hold roundups?

How do cowboys brand cattle?

What was the cattle boom? When did it occur?

How are cowboys of today like those of early days? How are they different?

Why were early cowboys called *cowpokes?*

What city is called "the cowboy capital of the world"?

COWELL, *KOW uhl*, **HENRY** (1897-1965), was an American composer. His works and theories greatly influenced experimental music in the United States.

Cowell developed the technique of *tone clusters*. He created these dissonant effects by having a pianist strike groups of keys with the fingers, fist, or forearm. Such European composers as Béla Bartók used tone clusters in their works.

Cowell composed an enormous amount of music, including 19 symphonies. Perhaps his greatest symphony is *Symphony No. 11 (Seven Rituals of Music*, 1953). Cowell based several symphonies on the music of India, Japan, and other Asian nations. His lifelong interest in folk music appears in such works as *Tales of the Countryside* (1941). Cowell also wrote a form of instrumental and vocal piece called *Hymn and Fuguing Tune* (1942-1957).

Cowell discussed his theories in the book *New Musical Resources* (1930). He and his wife, Sydney, wrote *Charles Ives and His Music* (1955). This book helped establish Ives's reputation as a major American composer. Cowell was born in Menlo Park, Calif. JAMES SYKES

COWLES, *kohlz*, is the name of an American family of newspaper editors and publishers.

Alfred Cowles (1832-1880) was one of five partners who bought the *Chicago Daily Tribune* (now the *Chicago Tribune*) in 1855. He was born in Mantua, Ohio.

William Hutchinson Cowles, Sr. (1866-1946), a son of Alfred Cowles, bought the *Spokane* (Wash.) *Spokesman* in 1893 and combined it with the *Review*, a rival paper. Cowles was born in Evanston, Ill., and began his newspaper work in Chicago. He became a director of the Associated Press in 1912.

Cheney Cowles (1908-1943), a son of William Hutchinson Cowles, became executive editor of the *Spokesman-Review* in 1938 and managing editor of the *Spokane Daily Chronicle* in 1939. He was born in Spokane, and was graduated from Yale University.

William Hutchinson Cowles, Jr. (1902-1971), brother of Cheney Cowles, became president of the Spokane Chronicle Company in 1936 and of the Cowles Publishing Company in 1946. The latter company publishes the *Spokesman-Review* and various farm journals. Cowles was born in Sands Point, N.Y., and was graduated from Yale University. JOHN ELDRIDGE DREWRY

COWLEY, ABRAHAM (1618-1667), was an English poet and essayist whose first volume of verse was published when he was 15. His major publications include *Poetical Blossoms* (1633), *The Mistress* (1647), and his unfinished epic *Davideis* (1656). Cowley began as a love poet strongly influenced by John Donne and his followers. Many of Cowley's love poems lack a personal note, and some are marred by fantastic imagery. Later, however, he began imitating the *Odes* of the Greek poet Pindar. This new style produced his best poem, "Ode to the Royal Society."

Cowley was born in London. As a follower of Charles II, he lived in exile during the Puritan revolution but was in great favor after the Restoration in 1660. Cowley helped form the Royal Society in 1660 and was one of its first members. RICHARD S. SYLVESTER

See also METAPHYSICAL POETS.

COWPEA, also called the BLACK-EYED PEA, is a member of the pea family. It grows wild in Asia, but is cultivated in the United States. It is a trailing or bushy vine, but does not climb. The flowers of the cowpea are yellowish-white to purple, and usually grow in pairs. In the South, the cowpea is usually grown for forage. Some kinds of cowpeas are a popular food, eaten in the pod or shelled. They also may be used in soups and stews.

Scientific Classification. The cowpea belongs to the pea family, *Leguminosae*. It is classified as genus *Vigna*, species *V. sinensis*. WAYNE W. HUFFINE

COWPENS, BATTLE OF. See REVOLUTIONARY WAR IN AMERICA (The War in the South).

COWPER, *KOO pur*, **WILLIAM** (1731-1800), was an English poet. His simple poems of nature and rural domestic life were forerunners of the works of the English romantic poets of the early 1800's.

Cowper was born in Hertfordshire, near London. He studied law, and was admitted to the bar in 1754. But he did not like law and never practiced. A shy, gentle man, he suffered fits of melancholy that were perhaps intensified by his devotion to strict Calvinistic religious beliefs. Frequent attacks of spiritual despair led to recurrent periods of insanity and two suicide attempts. In 1765, Cowper went to live in Huntington with the family of Morley Unwin, a clergyman. Beginning in 1767, after Unwin's death, he lived in the country at Olney with Mrs. Mary Unwin and her children, who cared for him tenderly.

Detail of a charcoal sketch by George Romney; National Portrait Gallery, London

William Cowper

During his healthy periods, Cowper wrote many great hymns. The *Olney Hymns* (1779), written with John Newton, a minister, includes the famous "Oh! for a Closer Walk with God" and "God Moves in a Mysterious Way."

Much of the charm of Cowper's poetry comes from his gracious, kindly personality. Cowper also had a good sense of humor. His comic masterpiece is the merry ballad "The Diverting History of John Gilpin" (1782). Cowper was angered by man's inhumanity to his fellow man. "Minds are never to be sold!" he declared in his antislavery poem "The Negro's Complaint." Typically, however, Cowper wrote quiet, descriptive, thoughtful poems about nature and everyday life. He liked tame, not wild, nature, and his emotions colored his poems. When he wrote "Yardley Oak" (1791), he did not describe the tree so much as his feelings when looking at the ancient oak, with its romantic suggestions of the past.

Cowper's major work was a 5,000-line poem called *The Task* (1785). This rambling poem in blank verse describes familiar rural sights and events—a teamster in a snowstorm, the arrival of the mail, the countryside in evening. The poem shows Cowper's love of the country and his distaste for city life. JOHN W. DODDS

COWPOX. See VACCINATION.

COWPUNCHER. See COWBOY.

COWRIE, *KOW ree*, or COWRY, is a sea snail with a shiny, colorful shell. It lives in the shallow waters of

warm seas. Cowries may be from ½ to 6 inches (1.3 to 15 centimeters) long. The top of the shell looks like a colorful egg, and the underside has a long, narrow opening bordered by many small teeth. There are more than 150 kinds of cowries. Some kinds are extremely rare and are worth hundreds of dollars to shell collectors. Cowries were once used as money in China, India, and Africa. One kind was worn as a badge of office by chieftains in the Fiji Islands. See SHELL (color pictures).

Scientific Classification. Cowries belong to the cowrie family, *Cypraeidae*. R. TUCKER ABBOTT

COWSLIP is any one of four plants: the marsh marigold; the shooting star, or American cowslip; the Virginia cowslip; and the European cowslip.

Marsh marigold grows in swampy places. Its bright yellow flowers appear from April to June. People often eat the leaves and stems of these plants for greens. *Virginia cowslip* is also called *Virginia bluebell*. Its bell-shaped flowers grow in clusters and always seem to be nodding.

Shooting star is the common name for a group of plants known as American cowslips. The flowers of these plants have an interesting shape. The petals bend backward, and the pistil and yellow stamens form a pointed tip that seems to shoot out of the flower. *European cowslip* grows in meadows throughout Europe. It has fragrant clusters of large yellow or purple flowers.

Scientific Classification. Marsh marigold belongs to the crowfoot family, *Ranunculaceae*. It is classified as genus *Caltha*, species *C. palustris*. Virginia cowslip belongs to the borage family, *Boraginaceae*. It is classified as *Mertensia virginica*. Shooting star and European cowslip belong to the primrose family, *Primulaceae*. Shooting stars make up the genus *Dodecatheon*. The European cowslip is classified as genus *Primula*, species *P. veris*. ROBERT W. HOSHAW

See also FLOWER (color picture: Flowers That Grow in Wet Places [Marsh Marigold]); PRIMROSE.

COX, ARCHIBALD. See WATERGATE.

COX, JAMES MIDDLETON (1870-1957), an American politician and newspaper publisher, was the Democratic candidate for President in 1920. He and his running mate, Franklin D. Roosevelt, were defeated by a Republican landslide that elected Warren G. Harding as President and Calvin Coolidge as Vice-President.

Cox began his political career by serving in the U.S. House of Representatives from 1909 to 1913. He was elected governor of Ohio in 1912, 1916, and 1918. Cox owned newspapers and radio and television stations in Ohio, Georgia, and Florida. In 1933 he served as a delegate to the World Monetary and Economic Conference in London. He wrote an autobiography, *Journey Through My Years* (1946).

Cox was born in a log-cabin farmhouse near Jacksonburg, Ohio. He left school at the age of 16, but through wide reading earned a license to teach. He bought his first newspaper at the age of 28. GEORGE M. WALLER

COXEY, JACOB SECHLER (1854-1951), gained fame as the leader of *Coxey's Army*, a group of unemployed men. During the depression of the 1890's, Coxey urged a huge road-improvement program to create employment. He organized an "army" to attract national attention, and marched out of Massillon, Ohio, with 100 men.

Coxey expected 100,000 more to join the ranks by the time he marched into Washington, D.C. But, when the group paraded in Washington on May 1, 1894, less than 500 men were in line. The "army" collapsed after Coxey was arrested by the police for walking on the Capitol lawn. Coxey was born in Selinsgrove, Pa. J. R. CRAF

COYOTE, *KY oat* or *ky OH tee*, is a wild animal of the dog family. It is noted for its eerie howl, usually heard in the early evening. The coyote lives in regions of western North America from Panama to Alaska. The

E. R. Kalmbach, U.S. Fish & Wildlife Service

The Coyote's Howl can be heard far away on quiet nights. The animal varies the long, sad howl with short barks and whines.

animal stands from 16 to 21 inches (41 to 53 centimeters) high at the shoulder. It has a bushy tail and erect ears. The soft fur of the coyote is light yellow or yellowish-gray, and may be tipped with black. The coyote is sometimes called the *prairie wolf*.

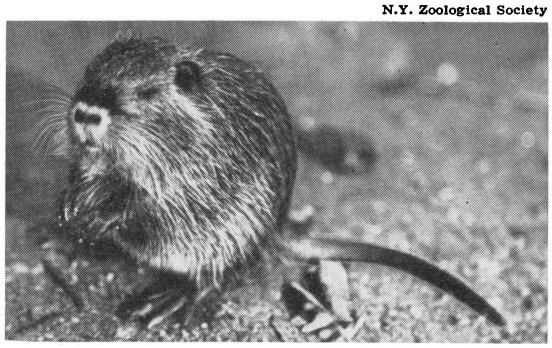
The coyote eats gophers, rats, rabbits, and animals it finds dead. Because it also kills and eats stray sheep or calves, it is often hunted by farmers and ranchers. However, many wildlife experts believe that coyotes do more good by destroying rodents than they do harm as killers of livestock. They are fast enough to catch jack rabbits, which eat the grass that is needed for food by sheep.

Scientific Classification. The coyote is a member of the dog and wolf family, *Canidae*. It is classified as genus *Canis*, species *C. latrans*. WILLIAM O. PRUITT, JR.

COYPU, *COY poo*, is a large rodent that lives near water. Its soft undercoat, called *nutria*, is a valuable

The Coypu's Valuable Fur Is Covered with Coarse Hair.

N.Y. Zoological Society



fur. Coypus look and act like beavers. They are about 3 feet (91 centimeters) long, including the tail, and weigh about 20 pounds (9 kilograms). Their hind feet are webbed. They have strong cheek muscles and sharp teeth, which they use to cut down plants. Coypus use plants for food and to build nests. Coypus live in lakes and ponds, and usually burrow into the banks to make their homes. Coypus originally lived in South America and are still common there. They have been introduced into Europe and North America, where they are raised for their fur. There are coypu (or nutria) farms in many parts of the United States and Canada.

See also FUR (Nutria).

Scientific Classification. Coypus belong to the hutia and coypu family, *Capromyidae*. They are genus *Myocastor*, species *M. coypus*. DANIEL BRANT

COYSEVOX, *kwahz VOH*, **ANTOINE** (1640-1720), was the leading French sculptor during the latter part of the reign of Louis XIV. Coysevox produced much of the sculpture that decorated the gardens and state apartments of the palace of Versailles. Much of his work reflected the tastes of Louis XIV. It is in a rich, ornamental style, reflecting a desire for dignity and grandeur.

Coysevox also made many portrait busts. Several of those he did later in his career are more informal and lively than his earlier decorative sculpture. This informality in his work reflected the developing taste of the 1700's.

Coysevox was born in Lyon, the son of a master woodworker. A picture of his statue *Mercury* appears in color in the SCULPTURE article. ROBERT R. WARK

COZZENS, JAMES GOULD (1903-), an American novelist, won a Pulitzer prize for *Guard of Honor* (1948). His novels *S.S. San Pedro* (1931) and *The Last Adam* (1933) became book-club selections. In 1957, he published *By Love Possessed*, perhaps his most popular work. In 1960, this novel received the Howells medal from the American Academy of Arts and Letters as the most distinguished work of American fiction published during the previous five years. Cozzens was born in Chicago and attended Harvard University. In his sophomore year, he published his first novel, *Confusion* (1924). Surprised by its success, he left Harvard to devote all his time to writing novels. JOHN O. EIDSON

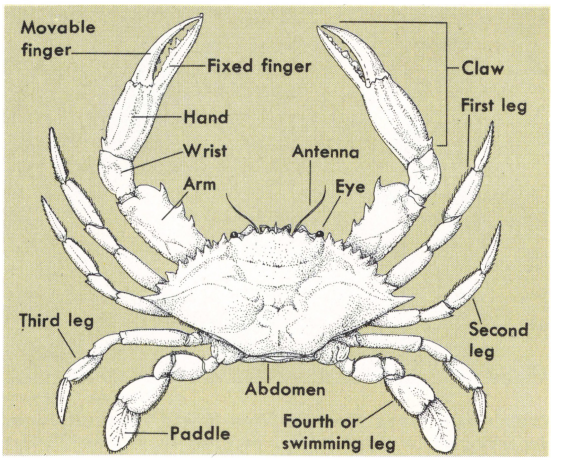
CPA. See ACCOUNTING.

CRAB is an animal that is covered by a hard shell, and that has jointed legs. It lives in shallow waters along the shore, and also in deep waters. Many kinds of crabs are valued by man as food. There are about 4,500 different kinds. Some kinds, such as fiddler crabs, live in burrows in the banks of salty tidal streams. Some other kinds of crabs live in fresh water or in burrows up to several miles or kilometers ashore.

The smallest crabs are the tiny pea crabs. The female pea crabs live in the sheltering shells of live oysters. The shape and relative size of the big claws of crabs differ greatly among the species, according to their habits. Male pincer crabs have one pincer much larger than the other. Hermit crabs live in empty sea shells and close them tightly, using one claw as a door. The color, form, and texture of claws, legs, and bodies run through many shades and shapes, and from smooth to rough and spiny. Some crabs are swimmers, and have paddles on the last pair of legs. Many crabs run sideways on the sand or rocks of the seashore. Crabs eat other small crustaceans and arthropods, and organic matter.

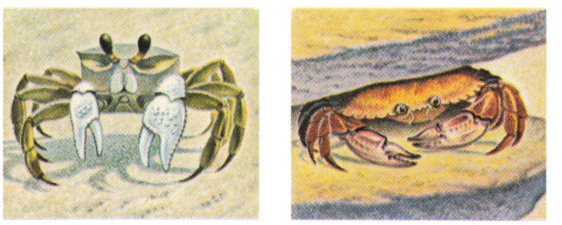
The *blue crab* is the most common crab sold as food in eastern American markets. When these crabs have shed their shells, and the new ones have not yet hardened, they are sold as the extra-choice *soft-shelled crabs*. Two types of edible crabs live on the Pacific Coast. The *Alaska king crab*, also called *Japanese crab*, is a good tasting crab that is caught by both American and Japanese fishermen. One of the largest crabs, its 12-pound (5.4-kilogram) body supplies much meat. The *Dungeness crab* is caught in shallow water from Cali-

PARTS OF A BLUE CRAB

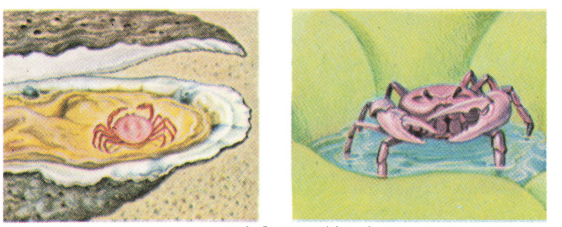


WORLD BOOK illustration by Marion Pahl

SOME KINDS OF CRABS



Crabs make up part of the animal life along many seashores. The ghost crab, *left*, lives in burrows on sandy beaches. Its color blends so well with sand that a motionless ghost crab seems to disappear. The rock crab, *right*, dwells on rocky seashores.



WORLD BOOK illustrations by James Teason

Several Crabs Live in Unusual Places. The female pea crab, *left*, lives in the shell of a live oyster. The pine crab, *right*, makes its home in bromeliad plants that grow on tropical trees. It lives in water that collects at the bottom of the plant.

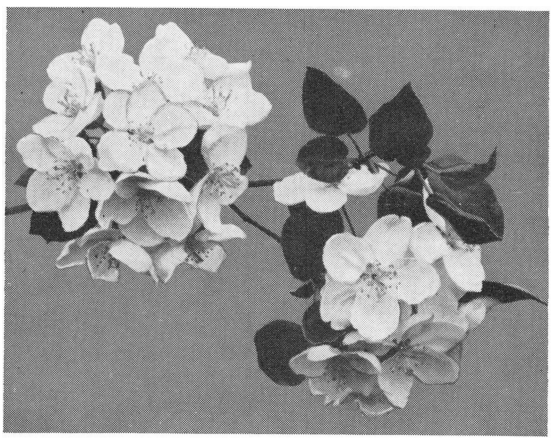
fornia to Alaska, and canned in Oregon, Washington, and Alaska. Crabs are taken in nets and wicker traps.

Scientific Classification. Crabs are in the phylum *Arthropoda*. They belong in the class *Crustacea* and the order *Decapoda*. J. LAURENS BARNARD

Related Articles in WORLD BOOK include:

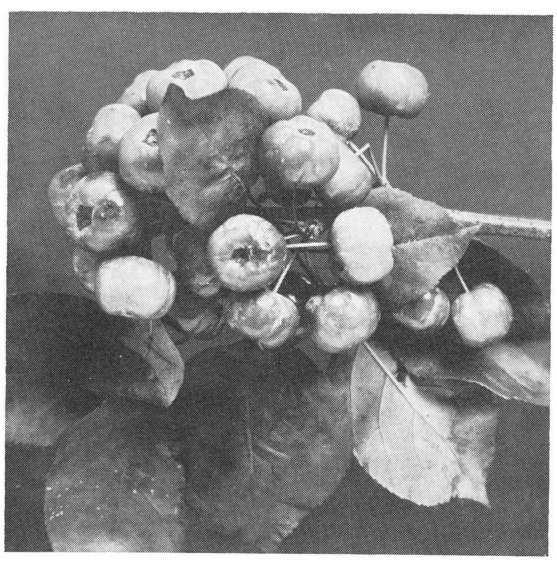
Animal (color picture: Coconut Crab)	Blue Crab	Fiddler Crab
Arthropod	Chile (picture: A Crab Fisherman)	Hermit Crab
	Crustacean	Washington (color picture)

CRAB APPLE is a tree that bears apples 2 inches (5 centimeters) or less in diameter. These trees grow wild from Siberia to northern China, and in North America.



J. Horace McFarland

Crab Apple Trees Blossom from March Through June, depending on the region in which they live. The fragrant flowers are white, pink, or deep rose, *above*. The tart apples, *below*, may be eaten fresh or made into delicious jellies.



They are grown in North America and other regions for their edible, round fruit. Crab apple trees are also popular as ornamentals. The trees usually are up to 20 feet (6 meters) tall, but some may grow 40 feet (12 meters) tall. They have large white to deep pink flowers that have a spicy fragrance.

The fruits vary from pure yellow through shades of yellow-red to pure red. Some taste bitter, but many are pleasantly tart and are eaten fresh. They are used in jellies, butter, and pickles. Crab apples are adaptable. They often crossbreed with other crab apples and with the common apple. Some crab apples and crab apple hybrids are so hardy they are used as rootstocks for common apples in cold climates.

Scientific Classification. Crab apples belong to the rose family, *Rosaceae*. The prairie crab apple is classified as genus *Malus*, species *M. ioensis*. The showy crab apple is *M. floribunda*. REID M. BROOKS

CRAB NEBULA. See ASTRONOMY (color picture: Wonders of the Milky Way); NOVA.

CRABBE, BUSTER. See SWIMMING (Famous Swimmers).

CRACKING. See PETROLEUM (Conversion).

CRACÓW. See KRAKÓW.

CRADLE OF LIBERTY. See BOSTON (introduction; The Freedom Trail).

CRADLE OF NEW FRANCE. See QUEBEC (city).

CRADLES OF CIVILIZATION. See CIVILIZATION (Cradlelands); ASIA (History).

CRAFT. See HANDICRAFT.

CRAFT GUILD. See GUILD.

CRAIG, EDWARD GORDON (1872-1966), an English stage designer, producer, and author, strongly influenced theater production and the art of stage settings after 1910. He founded a theater arts journal, *The Mask* (1908), and the School for the Art of the Theatre (1913) at the Arena Goldoni in Florence, Italy. His best-known book is *On the Art of the Theatre* (1911). Craig also wrote *The Art of the Theatre* (1905), *Toward a New Theatre* (1913), *Scene* (1923), and *Ellen Terry and Her Secret Self* (1931).

Craig was the son of the famed actress Ellen Terry (see TERRY, ELLEN ALICIA). He was born in Stevenage, England, on Jan. 16, 1872. He was graduated from Bradfield College, in England. BARNARD HEWITT

CRAMP is a condition in which either a single muscle or a group of muscles contracts, causing discomfort or pain. There may be only a single *spasm* (contraction of the muscle). Then the cramp begins and ends quickly and abruptly. The muscle spasms may continue over a long period. Cramps may involve any area of the body. Perhaps the best-known cramps are those of the stomach and intestines. These cramps may result from poor eating habits, or from chilling the stomach. They often cause common stomach-aches. Cramps are also characteristic of many diseases.

Cramps often result when certain muscles are used too much. For example, a person who writes for a long time may develop writer's cramp. Cramps sometimes result from hard, muscular work in a hot place. Foundrymen and firemen may develop cramps in their arms and legs. Athletes often develop cramps in the muscles they use most strenuously. For example, a runner may develop cramps in his legs, or a baseball pitcher may have cramps in his pitching arm. Doctors treat cramps with heat and massage, and give medicines to relieve pain. They may also administer drugs that relax the muscles. LOUIS D. BOSHES

CRANACH, *KRAH nahk*, **LUCAS, THE ELDER** (1472-1553), one of the leading German painters of the Renaissance, painted many portraits of the great men of his time. His portraits include those of King Christian II of Denmark, the Holy Roman Emperor Charles V, and such Protestant reformers as Martin Luther and Philipp Melanchthon. Cranach also painted many religious and mythological subjects, and became well known for his humorous versions of Greek mythology.

Cranach was born in the Franconian town of Cranach (now Kronach, Bavaria). He took his name from the town, and his real name is not known. Cranach lived most of his life in Wittenberg, where he was court painter. His three sons were minor artists. One was called Lucas Cranach the Younger. LESTER D. LONGMAN

CRANBERRY is an edible red berry that grows on a trailing vine. The cranberry vine grows in marshy or swampy land in the cool regions of the United States and Canada. It has small, oval, evergreen leaves and tiny pink flowers. Its fruits, the cranberries, may be round or oblong, depending on the variety. They grow on small, slender stems. The plant is called *cranberry*, or *craneberry*, because the slender stems of the fruit curve like the neck of a crane.

People use cranberries for sauces, jellies, and juice. They often grind the raw berries with other fruits to make relishes. Many families enjoy stringing the raw berries and decorating their Christmas trees with them.

Cranberry vines grow best in low-lying bog lands with acid soil. Growers remove wild growth from the bog, spread a shallow layer of sand over the area, then plant the vines. The plants grow from cuttings about 5 to 10 inches (13 to 25 centimeters) long. Workers push these cuttings through the sand layer so that the new roots will form in the soil beneath. They leave about 18 inches (46 centimeters) between the plants. After the plants begin to grow, they cover the area like a mat. Growers often flood their bogs early in winter to protect the plants from damage that might be caused by heating and thawing. Flooding at other times of the year prevents damage from insects and dry weather. Pesticides are also used to control insects. Leaf-eating insects damage cranberry plants.

Cranberry harvesting begins late in September. Pickers use special scooplike rakes to gather the berries. They place the berries in boxes, which are taken to packing houses. Machines separate the sound berries, blow out the chaff, and grade them. Packers put the berries in boxes or plastic bags for shipment to the market. Massachusetts and Wisconsin produce great quantities of cranberries. New Jersey and Washington are also important cranberry-growing states.

Scientific Classification. Cranberries belong to the heath family, *Ericaceae*. The large, or American, cranberry is genus *Vaccinium*, species *V. macrocarpon*. The small, or European, cranberry is *V. oxycoccus*. C. M. CHANEY

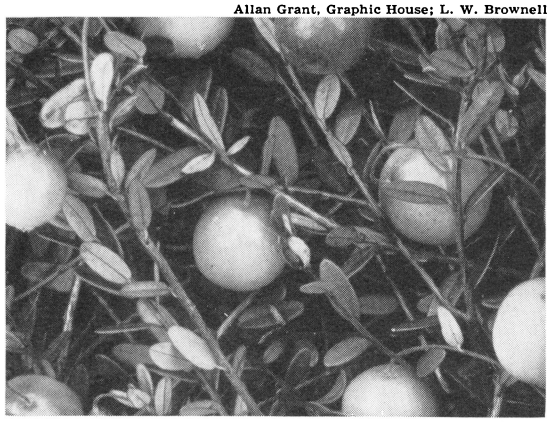
CRANBROOK ACADEMY OF ART. See UNIVERSITIES AND COLLEGES (table).

CRANE is a large bird, with a long neck and long legs. Cranes in flight can be distinguished from herons. Cranes fly with necks stuck out straight, and herons fly with necks curved. The largest crane in North America is called the *whooping crane* because of its loud, deep call. The loud call is aided by the bird's large windpipe, which is nearly 5 feet (1.5 meters) long. The bird stands 4 to 5 feet (1.2 to 1.5 meters) high. It has a wingspread of 6 to 8 feet (1.8 to 2.4 meters). Its feathers are white and the wings are tipped with black. The birds once ranged widely in the United States. However, by the mid-1970's, only about 50 wild whooping cranes were alive. They nest in northern Canada, and spend the winter in Texas.

There are three other kinds of cranes in North America. They are all brown or gray, and are about 3 feet (91 centimeters) high. Their wingspread is about 6 feet (1.8 meters). They have a small patch of bare red skin on their foreheads. One of them is the *little brown crane*, which breeds in the icy region of the Arctic Circle and spends the winter in the southwestern United States and Mexico. The *sandhill crane* is slightly larger. It breeds in Canada and in the Northern States west of the

Gathering Cranberries, workers use a special wooden scoop, *top*. Experienced pickers can rake the cranberries from the vines quickly. Some large cranberry growers use motor-driven picking machines. The fruit grows on small, slender stems, *below*. It is used to make sauces, jellies, puddings, and pies.

Allan Grant, Graphic House; L. W. Brownell



CRANE

The Whooping Crane, *right,* is the largest crane of North America. The bird has a wingspread of 6 to 8 feet (1.8 to 2.4 meters). It stands 4 to 5 feet (1.2 to 1.5 meters) tall. The whooping crane nests in northern Canada and spends the winter in Texas.

Fred W. Lahrman, Saskatchewan Museum of Natural History

Sarus Crane
Grus antigone
Found in Southeast Asia
from India to the Philippines
Body length: 60 inches
(152 centimeters)

Demoiselle Crane
Anthropoides virgo
Found in
south-central Eurasia
Body length: 38 inches
(97 centimeters)

Sandhill Crane
Grus canadensis
Found in northwestern and
southeastern North America
Body length: 44 inches
(112 centimeters)

WORLD BOOK illustrations by Walter Linsenmaier

Great Lakes, and flies south as far as Mexico in the winter. The *Florida crane* is found in southern Georgia and in Florida.

Cranes eat small plants, insects, frogs, worms, reptiles, small fish, and the eggs of water animals. Groups of cranes gather during the mating season to dance. The birds dance crazily and hop into the air with great excitement. At other times, the cranes stand on one leg and doze lazily, with their heads drawn back on their shoulders. They build nests in bushes or in marshes. The female lays only two eggs in a season.

Scientific Classification. Cranes are in the crane family, *Gruidae*. The whooping crane is genus *Grus*, species *G. americana*. The little brown crane is *G. canadensis*, variety *canadensis*. The sandhill crane is *G. canadensis tabida*. The Florida crane is *G. canadensis pratensis*. JOSEPH J. HICKEY

See also BIRD (Refuges and Sanctuaries; color picture: Birds of Other Lands); ANIMAL (color picture: Animals of the Polar Regions); HERON.

CRANE. See DERRICKS AND CRANES.

CRANE, HART (1899-1932), an American poet, is best known for his complex work *The Bridge* (1930), a major poem in modern American literature. Its subject is the Brooklyn Bridge in New York City, but its aim is to portray the history of the United States. The bridge becomes a symbol which spans the American migration from the Atlantic to the Pacific.

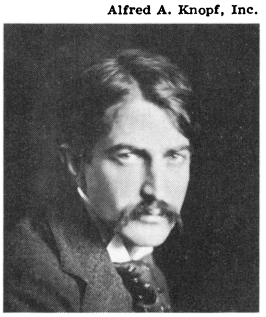
In *The Bridge*, Crane interweaves legendary figures from American history with modern inventions. Rip Van Winkle is portrayed as a passenger on a New York City subway. The subway itself is a vehicle that carries the reader backward into America's past and forward to a vision of its future. Although Crane was optimistic about life in America, his poem shows his awareness of the problems created by an industrial society.

Harold Hart Crane was born in Garrettsville, Ohio. He published only one other book of poetry during his lifetime, *White Buildings* (1926). CLARK GRIFFITH

CRANE, STEPHEN (1871-1900), was an American novelist, short-story writer, and poet. He produced an impressive number of realistic works, though he died of tuberculosis when he was only 28.

Crane was born in Newark, N.J. He briefly attended Lafayette College and Syracuse University before moving to New York City in 1891. There, his observations of slum life as a free-lance journalist inspired his first novel, *Maggie: A Girl of the Streets* (1893). Crane showed himself a master of irony in his sympathetic portrait of Maggie, who "blossomed in a mud puddle," but was driven to prostitution and finally suicide while only in her teens. Crane published the book at his own expense after publishers refused it because of its controversial nature.

Stephen Crane
Alfred A. Knopf, Inc.



Crane's next and greatest novel, *The Red Badge of Courage* (1895), takes place during the Civil War. It tells the story of Henry Fleming, a young Union soldier whose romantic illusions of war are brutally shattered by the reality of war's confusion and bloodshed. Crane shows how chance and impersonal forces contribute to Fleming's early cowardice in battle, his flight, and his later heroism.

The Red Badge of Courage earned Crane an international reputation. His fame increased with his first book of poems, *The Black Riders* (1895), with its sharp, ironic verses in free form. This work, together with another collection, *War Is Kind* (1899), includes many features of later poetic styles.

Crane's fame as an author of realistic war fiction brought him assignments in the late 1890's as a correspondent in the Greek-Turkish War and the Spanish-American War. During these years, he published his most famous short stories—"The Open Boat" (1897), based on his experiences following a shipwreck, and "The Blue Hotel" (1899). Crane spent his last two years in failing health, writing in Europe. DOMINICK CONSOLO

CRANE FLY. See DADDY LONGLEGS.

CRANE'S-BILL. See GERANIUM.

CRANIAL NERVE. See NERVOUS SYSTEM (The Peripheral Nervous System).

CRANIUM. See HEAD.

CRANK. See GASOLINE ENGINE (Crankshaft); STARTER; WHEEL AND AXLE.

CRANKCASE. See GASOLINE ENGINE (Parts).

CRANKSHAFT. See AUTOMOBILE (diagram: How an Automobile Runs); GASOLINE ENGINE (Parts).

CRANMER, THOMAS (1489-1556), was the first Protestant archbishop of Canterbury. He became famous for promoting the English Reformation during the reigns of Henry VIII and Edward VI.

Cranmer was born at Aslacton in Nottinghamshire. He attended Cambridge University, and later was appointed one of the university's public examiners of theology. In 1529, Cranmer came to the attention of Henry VIII, when he met with the king's advisers concerning Henry's divorce proceedings against Catherine of Aragon. Cranmer suggested that the divorce question be submitted to a debate by the English universities, which gave Henry a favorable verdict.

In 1533, Cranmer was appointed archbishop of Canterbury. As archbishop, he supported Henry's efforts to check the power of the pope and to become "justly and rightly . . . the Supreme Head of the Church of England." By the will of Henry VIII, Cranmer became one of the regents for young Edward VI. During Edward's reign, Cranmer supported many measures reforming the church and its doctrine.

Thomas Cranmer
Detail of an oil portrait by Gerlach Flicke; National Portrait Gallery, London

When the Roman Catholic Queen Mary took the throne in 1553, Cranmer and his Protestant workers were imprisoned in the Tower of London. In 1554, they were moved to a prison in Oxford, on the charge of heresy. Cranmer became so weak that he signed statements repudiating his former acts as archbishop. In one of his recantations, he acknowledged his submission to the

pope. Two days before his execution, it was arranged that Cranmer should make a final recantation, declaring his belief in every article of the Roman Catholic faith and repudiating his former writings. But, on the day he was to be burned at the stake, Cranmer declared that his only sins were his previous recantations. He thrust the hand that had signed the recantations into the fire and exclaimed, "This hath offended; oh, this unworthy hand!" GEORGE L. MOSSE

See also BOLEYN, ANNE; CATHERINE OF ARAGON; HENRY (VIII) of England; MARY (I); RIDLEY, NICHOLAS.

CRANNOG. See LAKE DWELLING.

CRANSTON, R.I. (pop. 74,287), is an industrial city on the west side of upper Narragansett Bay, just southwest of Providence, R.I. (see RHODE ISLAND [political map]). It has been a textile center since 1824, when William Sprague set up a shop for printing patterns with indigo dye. Other manufactures include textile machinery, brass and copper tubing, fire extinguishers, and plastic products. Cranston was settled about 1638 by friends of Roger Williams, the founder of Rhode Island. It was incorporated as a town in 1754, and received its city charter in 1910. It has a mayor-council form of government. CLARKSON A. COLLINS III

CRAPE, a variant of crepe. See CREPE.

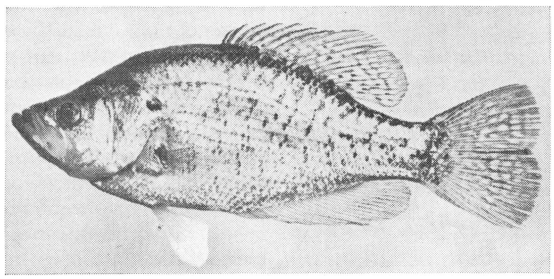
CRAPE MYRTLE is a handsome shrub or small tree about 10 to 20 feet (3 to 6 meters) tall. It is native to southern Asia, but is often planted along streets in the southern United States. It blooms from July to September. The flowers are about 1 inch (2.5 centimeters) wide and grow in clusters. The petals are usually bright pink to red-purple, or sometimes white. The leaves grow from 1 to 3 inches (2.5 to 8 centimeters) long.

Scientific Classification. The crape myrtle belongs to the loosestrife family, *Lythraceae*. It is genus *Lagerstroemia*, species *L. indica*. ARTHUR CRONQUIST

CRAPPIE, *KRAP ee*, is a fresh-water fish which is closely related to sunfish and black bass. It is found in sluggish, shallow waters of the Midwestern and Southern United States. The crappie is silvery olive with dark-green spots. It is about 1 foot (30 centimeters) long when full grown. It has a high fin on its back and a similar one on its belly. Each of these high fins contains five to eight spines, and about 18 soft rays. The tail fin is shaped like the letter *V*. The crappie has a large mouth. It feeds on insects, small fishes, and other animals. Crappies are good to eat, and they are good game fish. Spinners may be used in trolling or casting for crappies. Crappies are called by many other names, including bridge perch, bachelor perch, chinquapin perch, strawberry bass, calico bass, and sacalait. See also BASS.

The Crappie, found in the waters of the Midwestern and Southern states, is silvery olive in color, with dark-green spots.

Hugh Davis



Scientific Classification. The crappie belongs to the sunfish family, *Centrarchidae*. The white crappie is classified as genus *Pomoxis*, species *P. annularis*. The black crappie is *P. nigro-maculatus*. CARL L. HUBBS

CRASSUS, MARCUS LICINIUS (112?-53 B.C.), was a Roman statesman, financier, and military leader. Crassus, Caesar, and Pompey formed the *First Triumvirate* (a three-man ruling body) in 60 B.C. Crassus had previously held the high government posts of praetor, consul, and censor. He was called *the Rich* because he made much money through real estate investments. He used his position to gain favors for his friends in business.

In 71 B.C., Crassus crushed the revolt of the gladiator Spartacus (see SPARTACUS). Seeking military glory, Crassus launched a war against Parthia, an area in central Asia. In 53 B.C., Parthian archers trapped Crassus' army, and killed Crassus and most of his troops. CHESTER G. STARR

See also CAESAR, GAIUS JULIUS; TRIUMVIRATE.

CRATER is a funnel- or bowl-shaped depression in the earth. It may be formed on plains, or on the sides of mountains, but most craters lie at the tops of volcanic cones. A few are blasted out by explosions. But the majority are formed simply by the volcanic cone building up around them as showers of rock fragments, thrown into the air by explosions, fall back around the vent. Ordinary craters range up to 1 mile (1.6 kilometers) across, and may be as much as 2,000 feet (610 meters) deep. Other craters are formed by the sinking of the ground surface as supporting liquid lava is withdrawn from beneath. The great depression occupied by Crater Lake in Oregon and the crater of Kilauea in Hawaii were formed in this way. Geologists call small sunken craters *pit craters*. The larger sunken craters, called *calderas*, may be as much as 20 miles (32 kilometers) across. GORDON A. MACDONALD

See also METEOR (Meteorites; picture); MOON.

CRATER LAKE is the deepest lake in the United States and one of the world's scenic wonders. It is located in the crater of Mount Mazama, an inactive volcano in the Cascade Mountains of Oregon. The lake is 6 miles (10 kilometers) across at its widest point. It covers 20 square miles (52 square kilometers). Its surface is about 6,000 feet (1,800 meters) above sea level. The lake is about 2,000 feet (610 meters) deep. There are no known outlets and no streams flowing into it.

Geologists believe the lake was formed thousands of years ago, when the top of Mount Mazama, then about 14,000 feet (4,270 meters) high, collapsed and was swallowed up inside the mountain. This left a huge "bowl" which gradually filled with water. A small volcano called Wizard Island formed in the lake when lava erupted later from the interior of Mount Mazama.

At first there were no fish in Crater Lake but trout were placed there in 1888 and fish have been added each year. The Klamath Indians believed the lake's waters had healing qualities. John Hillman, a mining prospector, discovered Crater Lake in June, 1853. He named it Deep Blue Lake. The area was made a national park in 1902. RICHARD M. HIGHSMITH, JR.

See also OREGON (color picture).

CRATER LAKE NATIONAL PARK was created in southwestern Oregon to preserve Crater Lake and the forests around it. The walls of an ancient volcano, Mount Mazama, rise from 500 to 2,000 feet (152 to 610 meters) above the surface of the lake. They have been changed by the weather into fantastic forms and to various shades of brown and bright yellow. Several peaks of the Cascade Mountains, including Mount Scott, Cloud Cap, and Llao Rock, rise near Crater Lake. Coniferous trees cling to broken rocks around the lake and are reflected by the waters. There are more than 500 kinds of flowering plants, ferns, and flowers in the meadows and on the slope of the volcano. Wild animals and birds are also plentiful. Each year more than 300,000 tourists visit the park. President Theodore Roosevelt set 10 Oregon townships aside in 1902 to create the park, which covers 160,290.33 acres (64,867.19 hectares). RICHARD M. HIGHSMITH, JR.

CRATERS OF THE MOON NATIONAL MONUMENT is in south-central Idaho. For location, see IDAHO (physical map). This unusual region has a number of volcanic cones, craters, lava flows, caves, natural bridges, and other sights. Each year many tourists visit the 53,545.05-acre (21,668.91-hectare) monument. It was established as a national monument in 1924.

CRAVAT. See NECKTIE.

CRAWFISH. See CRAYFISH.

CRAWFORD, ISABELLA VALANCY. See CANADIAN LITERATURE (After Confederation).

CRAWFORD, THOMAS (1813?-1857), an American sculptor, designed the *Statue of Freedom* on the dome of the Capitol in Washington, D.C. He also designed the bronze doors for the main eastern entrances of the Senate and House wings. Crawford created a monument to George Washington in Richmond, Va. His other works include statues of the composer Ludwig van Beethoven and the statesman Henry Clay, *Mercury and Psyche*, and *The Indian*. He also sculptured several biblical subjects.

Crawford was born in New York City. He went to Rome at the age of 20 to study under the Danish sculptor Bertel Thorvaldsen. His statue *Orpheus Entering Hades* brought him his first fame. He became blind the year before he died. JEAN LIPMAN

CRAWFORD, WILLIAM HARRIS (1772-1834), an American politician and statesman, became a Southern leader in national politics. His Democratic-Republican Party believed in an extreme form of states' rights.

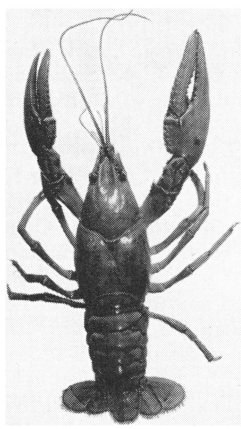
Crawford served as a United States senator from Georgia from 1807 to 1813. He was also secretary of the treasury under Presidents Madison and Monroe from 1816 to 1825. He had a chance to be elected President of the United States in 1824 (see ADAMS, JOHN QUINCY [Election of 1824]). He was born in Amherst County, Virginia. RICHARD N. CURRENT

CRAYFISH, or CRAWFISH, is a fresh-water crustacean that is closely related to the lobster. It lives in and along lakes and rivers and is found on every continent except Africa and Antarctica. The crayfish seldom grows over 6 inches (15 centimeters) long. It varies in color from white through pink, orange, and brown, to greenish-black and dark blue. The clear white crayfish is a blind animal that lives in underground rivers.

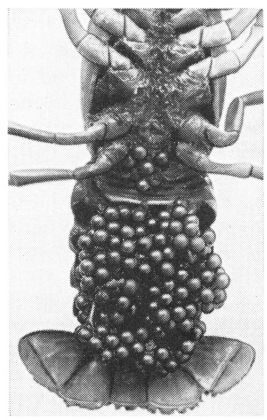
A hard structure called the *exoskeleton* covers the body of the crayfish. This serves as a suit of armor to protect the soft tissues of the body from injury. The body is divided into sections, or segments. The front part of the body is rigid, but the back part, or abdomen, has movable segments. The crayfish has five legs on each side of the body. The two front legs are shaped into large, sharp claws, or pincers. They are similar to those of the lobster, and are used to capture and hold the prey. The four other pairs of legs are used for walking. *Swimmerets* (leglike structures used in reproduction) are located under the abdomen. The crayfish also has two long feelers, or antennae, and two shorter ones.

The crayfish feeds on snails, small fish, tadpoles, or the young of insects. It is more active at nightfall and at daybreak, when it comes out of its burrow or from under a stone. It has burrowing habits which may destroy cropland or weaken levees and mill dams. One kind digs down to water in damp meadows and throws up clay "chimneys" in the process. The crayfish is a fighter. If it loses one of its walking legs, or one of its claws in battle, a new member soon grows in its place.

The crayfish is considered good food in Europe. In



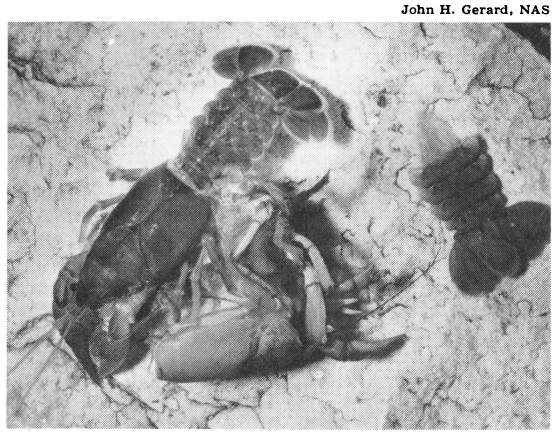
Hugh Spencer



Cornelia Clarke

The Crayfish escapes from danger by using snapping motions of its abdomen to swim backward rapidly. It paddles with the leaflike growths on the end of its tail. The female, *above right*, carries her eggs on the underside of her abdomen until they hatch. The crayfish sheds its protective outer skin, or *exoskeleton, below,* when its body has outgrown the hard shell.

John H. Gerard, NAS



America it is eaten chiefly in cities or districts where there are many people who came from Europe.

Scientific Classification. Crayfish belong to the family *Astacidae*. The American crayfish are genus *Cambarus*, species *C. virilis*, and *C. bartoni*. European crayfish are *Astacus fluviatilis*. JERRY LAURENS BARNARD

See also CRUSTACEAN; LOBSTER.

CRAYON is a piece of charcoal, colored chalk, waxy substance, or other material, shaped like a pencil. Schoolchildren use waxy crayons to color pictures on paper. They write on blackboards with chalk crayons. *Pastel crayons* are made of a chalk paste. Artists use them to draw pictures called *pastels*, which have soft colors and a dry, dusty look. Charcoal crayons are used chiefly for quick sketches. Crayons used in lithographic printing are usually made of a mixture of wax, soap, resin, and lampblack. See also CHALK; PASTEL. ERIC Q. BOHLIN

CRAZY BONE. See FUNNY BONE.

CRAZY HORSE (1844?-1877) was a great chief of the Minneconjou band of the Oglala Sioux Indians. The U.S. Cavalry destroyed his village because he disregarded the government's order to enter a reservation. Seeking revenge, he became one of the main leaders in the Sioux War of 1876. Crazy Horse led the Sioux and Cheyenne who defeated General George Crook in the battle of the Rosebud in Montana. Eight days later, he led the Indians in the battle of the Little Bighorn, where General George A. Custer and his command were wiped out (see CUSTER, GEORGE ARMSTRONG).

As a boy, Crazy Horse was named Curly. After his first great war deed, his father, who was himself a chief named Crazy Horse, gave his name to the boy. Crazy Horse had light skin and hair. He had a quiet manner, and did not boast of his great war deeds as was the tribal custom. He had unusual spiritual powers. The Sioux called him their "Strange One." In 1877, he voluntarily surrendered to American troops. The jealousy of Sioux who were friendly to the whites led to his arrest (see RED CLOUD). Crazy Horse was killed in 1877 at Fort Robinson, Nebr., by a soldier while the chief was being forced into a jail cell. A gigantic figure of Crazy Horse is being sculptured out of a mountain in the Black Hills of South Dakota by Korczak Ziolkowski. E. ADAMSON HOEBEL

CRAZY HORSE MEMORIAL. See SOUTH DAKOTA (Places to Visit; color picture); CRAZY HORSE.

CREAM. See MILK (Fats); SEPARATOR; BUTTER.

CREAM NUT. See BRAZIL NUT.

CREAM OF TARTAR, also called POTASSIUM BITARTRATE, or POTASSIUM HYDROGEN TARTRATE, is a white, crystalline substance with a slightly acid taste. It is found in grapes and other fruits. It is used in baking recipes, and in the manufacture of baking powder. It is also used in tin-plating metals and as a laxative in medicine. Cream of tartar comes from *argol*, the crude tartar sediment that settles in wine barrels. Cream of tartar has the chemical formula $KHC_4H_4O_6$. See also BAKING POWDER. OTTO THEODOR BENFEY

CREAM SEPARATOR. See SEPARATOR.

CREAMERY. See BUTTER (How a Creamery Makes Butter).

CREASEY, JOHN (1908-1973), an English author, became one of the best-known writers of detective stories of the 1900's. He published more detective fiction than any other writer of his time—over 500 novels written under at least 20 names. Most critics consider Creasey's stories uneven in quality but have praised his best ones for their fast-paced action and clever plots.

Creasey created several detectives. Under his own name, he wrote three separate series of novels about Inspector Roger West of Scotland Yard and two amateur detectives, Dr. Stanislaus Palfrey and Richard Rollison. Rollison is known as the Toff, an English slang word for a stylishly dressed man. Perhaps Creasey's most popular detective is Commander George Gideon of Scotland Yard. Creasey wrote the Gideon books under the name of J. J. Marric. Creasey's other pen names include Gordon Ashe, Norman Deane, Michael Halliday, Kyle Hunt, Peter Manton, Anthony Morton, and Jeremy York. Creasey was born in the county of Surrey. HERBERT BREAN

CREASY, SIR EDWARD SHEPHERD. See BATTLES, FIFTEEN DECISIVE.

CREATION. See LIFE (The Origin of Life).

CRÈCHE. See TABLEAU.

CRÉCY, *KRAY SEE,* **BATTLE OF,** was the first important battle of the Hundred Years' War. It took place in 1346 at the site of the present town of Crécy, in the French department of Somme. English troops under Edward III defeated a much larger French army under Philip VI. Almost half the French force was wiped out, including more than a thousand knights. English archers on foot proved more effective than armor-clad French knights astride their chargers. The Battle of Crécy was one of the first times English soldiers used gunpowder. The hero of the battle was Edward, the Black Prince, son of Edward III of England. ROBERT S. HOYT

See also EDWARD (III); EDWARD (The Black Prince); HUNDRED YEARS' WAR.

CREDIT, in education. See UNIVERSITIES AND COLLEGES (Curriculum).

CREDIT in business permits a business or individual to purchase goods or services and pay for them at a later date. By using credit, a government borrows money to provide vital services for its citizens. Businesses borrow money to buy raw materials and build factories. Individuals borrow money to buy items such as homes.

Types of Credit. There are many types of credit. They can be called by different names. Most economists agree that the most important types are commercial credit, consumer credit, and investment credit.

Commercial credit is used by businessmen to obtain money to carry on their business. For example, suppose a toy manufacturer wants to increase his production before Christmas by hiring more workers and buying more materials. But he does not have enough money on hand. To solve his problems, he uses his credit to borrow the money and repay it from the money he receives from the Christmas sales. These loans usually run from 60 days to 6 months and are called *short-term credit.*

Consumer credit permits individuals to purchase goods they could not afford if they had to pay immediately. A person may use the *installment plan* or the *deferred-payment* plan to buy a new car. He may buy a refrigerator from a department store through a *charge account* with that store. Or, he may buy a house with a *mortgage* from a bank. Normally, the person who buys on credit agrees to repay a certain part of his debt each month.

But in all cases, he obtains the goods immediately and pays for them over a period of time.

Investment credit allows a business to obtain credit for capital goods. For example, suppose the toy manufacturer wants to expand his business by building another factory, but lacks the money. He borrows the money and repays it over several years because the loan is very large. This is called *long-term credit.*

Sources of Credit. Credit comes from many places. Some credit is available for any purpose, while other credit is available only for specific uses. In the United States, commercial banks provide the largest share of credit of all types. Insurance companies provide investment and consumer credit. Credit unions and finance companies provide consumer credit.

Government agencies offer credit, usually for a specific purpose. Several government agencies offer credit only to farmers and farmer organizations. Others offer credit for housing or to assist small businesses.

Dangers of Credit. Consumers, businesses, and governments must be careful they do not use too much credit. A consumer who uses too much credit creates financial hardship for himself and may lose the goods he has purchased. A business that cannot pay its debts can go bankrupt. Governments that borrow too much can destroy the public's confidence in the national currency. In modern times, inflations and depressions have resulted from the misuse of credit by a government and its citizens. JAMES B. LUDTKE

Related Articles in WORLD BOOK include:

Banks and Banking	Finance Company	Loan Company Mortgage
Credit Card	Inflation and Deflation	Pawnbroker
Credit Union	Installment Plan	Savings and Loan Association
Farm Credit Administration		

CREDIT, LETTER OF. See LETTER OF CREDIT.

CREDIT CARD permits its holder to buy goods or obtain services without paying for them immediately. The buyer pays later. In the early 1970's, millions of persons were using credit cards to make telephone calls, rent automobiles, and to buy all types of merchandise. Credit cards are generally issued by business firms only to persons who have established a good record for paying their bills. They usually are made of plastic or stiff cardboard. Each card has a number that helps the business identify the credit card holder. Sometimes these cards are called *charge plates.*

Several companies issue credit cards that can be used in thousands of stores or businesses. These cards are used by many businessmen who want to keep a full record of the expenses of a trip. Hotel and oil company credit cards are among the most common types.

In most cases, a person who uses a credit card gets a bill for the amount of money he spent for credit purchases during the previous month. Unless some other form of credit has been agreed upon, he is expected to pay the bill promptly. LEONARD S. SILK

CREDIT INSURANCE. See INSURANCE (Casualty, Surety, and Fidelity Insurance).

CREDIT MOBILIER OF AMERICA, *moh BEEL yer,* was a joint-stock company responsible for a major political scandal in the history of the United States. It was first chartered in 1859 as the Pennsylvania Fiscal Agency. In 1864 it came under the control of the Union Pacific Railroad Company, which renamed it and turned it into a construction company for the Union Pacific. That railroad had been chartered by the government on the following terms: for each mile (1.6 kilometers) of track built, the government was to give the road 10 sections of public land and from $16,000 to $48,000 in United States bonds, depending on how difficult the country was to build through.

Actually, this was far more than was needed to build the road. But since the same men owned the Union Pacific and the Credit Mobilier, the railroad gave the contracts to the construction company on such terms as to make sure that all the government funds should be spent, with enormous profits for the owners. The result was that shares in Credit Mobilier rose with suspicious rapidity. To keep the government in line, Oakes Ames, manager of Credit Mobilier, who was also a congressman from Massachusetts, distributed stock at far below market price to members of Congress and government officials, and even loaned them money to pay for it. These transactions were exposed in 1872. Vice-President Schuyler Colfax and other high government officials were accused of accepting bribes. Congress strongly reprimanded one of the government directors of the railroad and two Congressmen, Ames and James Brooks of New York. The builders of the Union Pacific kept their profits, and federal funds that were intended as a permanent endowment for the road passed into private hands.

The name *Credit Mobilier* was taken from a French banking firm which was likewise involved in a public scandal. Established in Paris in 1852, the firm became powerful, and, at the expense of small investors, the promoters acquired huge fortunes. Extravagant speculation ruined the firm in 1869. The small investors lost their investments, but the promoters kept the great sums they had built up. JOHN DONALD HICKS

CREDIT UNION is a cooperative savings and loan association operated by the members exclusively for their own mutual benefit. The members pool their savings. When one of them needs to borrow money for some useful or necessary purpose, he may do so at a low rate, commonly one per cent a month on the unpaid balance. Credit unions are often organized among the employees of companies or members of farm groups, labor unions, and educational, religious, and social institutions. In the early 1970's, there were over 23,800 credit unions in the United States with a membership of about 23 million. The unions had savings of nearly $15\frac{1}{2}$ billion and assets of about $18 billion. Deposits in credit unions are insured up to $40,000 per account by the federal government.

Cooperative credit societies originated in Germany when Hermann Schulze, mayor of Delitzsch, organized one in 1848. Alphonse Desjardins organized the first credit union in North America in 1900 in Lévis, Quebec, in Canada. Desjardins came to Boston early in 1909 and helped Edward A. Filene, a Boston department store executive, draft a bill in the Massachusetts legislature to make credit unions legal in that state. Over half of all credit unions in the United States operate under federal charters under the supervision of the National Credit Union Administration. The others are chartered by individual states. G. L. BACH

CREDITOR. See DEBT; COLLECTION AGENCY.

CREE INDIANS once occupied a large part of Canada, from southwestern Quebec to Saskatchewan. They were related by language to the Algonkian family.

In the middle 1700's a small group of Cree moved west into Alberta and south into the United States. These *Plains Cree* became buffalo hunters, and lived like the other Plains tribes (see INDIAN, AMERICAN [Table of Tribes]).

Woodland, or *Woods*, *Cree* lived mainly by hunting and fishing. They hunted moose on the southern borders of their forest country, but caribou provided the chief game farther north. These Cree also hunted bear, beaver, wild fowl, and fish, wandering far and wide in search of their food. The Woodland Cree wore clothing and moccasins of moosehide, caribou skins, and other furs. These Indians usually traveled by birchbark canoe in summer, bypassing the tangled forests and swamps. They used snowshoes and sleds for winter hunting in the deep, soft snow of the forest. Cree society was organized around the family. Dream visions were important to the Cree hunter, because he believed that they brought him a protective guardian spirit.

About 1,000 Plains Cree live on reservations in Manitoba and Montana. The 32,000 Woodland Cree live on reserves in Quebec, Ontario, Manitoba, Saskatchewan, and Alberta. Many of the Cree live much as their ancestors did. ELMER HARP, JR.

CREED, AMERICAN'S. See AMERICAN'S CREED.

CREED, APOSTLES'. See APOSTLES' CREED.

CREED, NICENE. See NICENE COUNCILS.

CREEK INDIANS formed a confederation that included a group of tribes originally located in present-day Alabama and Georgia. The Creek were also called the MUSKOGEE (*mus KOH gee*). They later moved to Oklahoma as one of the Five Civilized Tribes (see FIVE CIVILIZED TRIBES).

Creek farming settlements lay along the Coosa, Tallapoosa, and Chattahoochee rivers. There were almost 50 towns in the Creek confederacy, which was created mainly as protection against enemy attack. The Creek enjoyed music and played the ball game now called lacrosse. Every summer they held a four- or eight-day festival called the *puskita*, or *busk*, to celebrate the ripening of new corn. During this period of peace, the people threw away their old clothes and household utensils. They kindled new fires as symbols of the new year. The Creek were noted for their diplomatic skill and for their wisdom in council.

During colonial days, the Creek were friendly with the British colonists but not with the Spaniards. The Creek fought against the United States in the Creek War (1813-1814), which ended in the surrender of Creek lands (see INDIAN WARS [In the South]). The Creek then moved to Indian Territory (now Oklahoma), where they established their own government, schools, and other institutions. The Creek and other tribes in Indian Territory helped separate the white settlers who were moving westward from the hostile Southern Plains tribes.

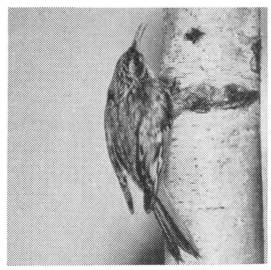
Today, most Creek live in Oklahoma. A few live in Alabama, Louisiana, and Texas. Only a few of the old customs remain. The Old Creek Indian Council House still stands in Okmulgee, Okla., as a memorial to the tribe. WILLIAM H. GILBERT

CREEL, GEORGE (1876-1953), a newspaperman and author, served as chairman of the Committee on Public Information, the United States information agency in World War I. His committee promoted voluntary newspaper censorship of confidential war information. Creel served as chairman of the advisory committee of the Works Progress Administration in 1935 and as U.S. Commissioner to the Golden Gate International Exposition in 1939.

Born in Lafayette County, Missouri, Creel edited the Kansas City *Independent* from 1899 to 1909. His crusade for clean government in Kansas City won him acclaim. Later he worked in Denver with the *Post* and the *Rocky Mountain News* from 1909 to 1913. His many books include *How We Advertised America* (1920) and *War Criminals and Punishment* (1944). JOHN ELDRIDGE DREWRY

CREEPER. See VIRGINIA CREEPER.

CREEPER is the name of a family of small, busy birds much like the woodpeckers in their habit of climbing trees. Most creepers are found in Europe, but the common *brown creeper* lives in North America. It is widespread in southern Canada but is frequently observed in the southern part of the United States in winter. The creeper is smaller than the sparrow. Its brown plumage, streaked with white, looks almost like the rough bark of the trees it climbs. It is grayish-white on its underparts. The bird moves around a tree from the base upward. It uses its curved bill and sharp tongue to pick out every insect and spider egg it can find in the bark. Insects and seeds make up its only food.



Hugh M. Halliday

The Brown Creeper uses its strong feet and 12 stiff tail feathers to cling to a tree.

The creeper has a "wild, sweet song," heard only when the bird makes its nest behind loose bark. The female lays five to eight white eggs with brown spots.

Scientific Classification. The creeper belongs to the creeper family, *Certhiidae*. The brown creeper is genus *Certhia*, species *C. familiaris*.

See also BIRD (color pictures: Birds of Other Lands [Blue Honey Creeper; Wall Creeper], Types of Beaks).

CREEPING BENT. See BENT.

CREIGHTON UNIVERSITY. See UNIVERSITIES AND COLLEGES (table).

CREMASTER. See BUTTERFLY (Pupa).

CREMATION. See FUNERAL CUSTOMS.

CRÉMAZIE, OCTAVE. See CANADIAN LITERATURE (The Rise of French-Canadian Literature).

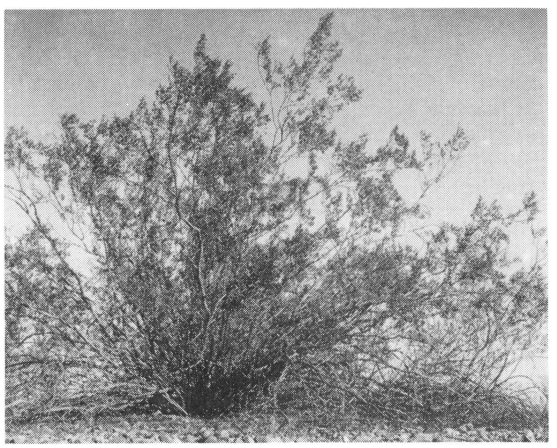
CREOLE, *KREE ohl*, is a term used loosely to indicate descendants of French or Spanish settlers of an area. It comes from the Spanish word *criollo*, meaning *native to the place*. It is also used in speaking of Creole peoples' languages or local products, as in the terms *Creole pralines* or *Creole cooking*. In the United States, *Creole* now refers only to white descendants of French or Spanish settlers of the Gulf States. In colonial Latin and South America, white persons born in the Western Hemisphere were called *Criollos* (Creoles). See NEW ORLEANS (The People); LATIN AMERICA (Struggle for Independence). WILTON MARION KROGMAN

CREOSOTE, *KRE oh soht,* is a heavy, oily liquid made by distilling wood or coal tar. It has a penetrating, smoky smell and is nearly colorless when pure. Creosote as marketed is commonly a brownish color, and is a mixture of several substances such as cresol. Creosote oil taken from beechwood tar has been used in medicine. This oil is made chiefly of creosote and guaiacol.

Creosote obtained from coal tar is one of the most effective wood preservatives. It has been used for this purpose for over 100 years. It is also used as pitch for roofing. Creosote is sometimes used to neutralize bad odors. It is a dangerous poison. AUSTIN SMITH

See also CRESOL; TAR.

CREOSOTE BUSH is a desert shrub that grows in the southwestern United States and Mexico. It is an evergreen, and smells like balsam. The creosote bush grows about 5 to 8 feet (1.5 to 2.4 meters) high. It has many branches, and produces a resin. The leaves are made up of two tiny leaflets about $\frac{1}{3}$ inch (8 millimeters) long, and shaped slightly like an egg. They have no stalk. The creosote bush has tiny yellow flowers. The fruit is round and white, and feels like felt. Creosote bushes grow in sandy, light soil, and need much sunlight. Although it is sometimes called *greasewood*, the creosote bush is different from the true greasewood.



Willis Peterson

Creosote Bushes require a great amount of sunlight and grow only in desert regions in southwestern United States and Mexico.

Scientific Classification. The creosote bush belongs to the caltrop family, *Zygophyllaceae*. It is genus *Larrea*, species *L. tridentata*. J. J. LEVISON

CREPE, *krayp,* is the term for fabrics woven so that the cloth has a crinkled, or rippled, surface. Crepe fabrics are woven from tightly twisted yarns, some of which may be twisted to the right and some to the left, causing the yarns to spring back into *kinks*, or curls, after the weaving. Crepe fabrics may also be made by weaving, chemical treatment, or embossing (see EMBOSSING). Crepe fabrics may be woven from silk, wool, rayon, or synthetics. *Mourning crepe* is a black, dull silk with deep grooves pressed into the surface. It is used for mourning bands to be worn on the arm, or as part of funeral wreaths. *Crepe paper*, used in decorating, is colored paper which is crinkled to look like crepe cloth. The word *crepe* comes from the Latin verb form *crispare*, which means *to curl*. KENNETH R. FOX

CRERAR, *KREE rahr*, HENRY DUNCAN GRAHAM (1888-1965), distinguished himself as commander of the First Canadian Army in the invasion of the Rhineland and western Netherlands in World War II. He served as Chief of the Canadian General Staff in 1940 and 1941, and commanded the First Canadian Corps in Great Britain and Italy from 1942 to 1944. He was noted for his skill and determination.

Born in Hamilton, Ont., Crerar studied at Upper Canada College, at Lausanne, Switzerland, and at the Royal Military College in Kingston, Ont. He joined the Canadian Expeditionary Force in 1914 as an artillery captain and served throughout World War I. Crerar retired from the army in 1945. JEAN BRUCHÉSI

CRESCENDO. See MUSIC (Terms).

CRESCENT, *KREHS uhnt,* is a symbol that resembles the moon in its first quarter. In heraldry, the crescent is usually shown with its *horns* (ends) pointing up. If the horns are shown pointing to the left of the wearer of a heraldic shield, the crescent is called *decrescent*. If the horns point right, it is called *increscent*. If they point down, it is a *crescent reversed*.

The people of Constantinople used the crescent as their symbol. When the Turks conquered the city, they adopted it as their symbol. It appears in the flag of Turkey. In Moslem countries, a flag with a red crescent on it means the same thing as a red cross on a flag in other countries. ARTHUR E. DUBOIS

CRESOL, *KREE sohl,* is the common name for a group of chemicals that scientists call *hydroxytoluenes*. Creosote oil contains cresols, and is used to preserve railroad ties, fence posts, and other wood used outdoors (see CREOSOTE). Antiseptic soaps and emulsions are made from a purified mixture of the known cresols: orthocresol, metacresol, and paracresol. These soaps and emulsions find medical use as antiseptics for minor cuts and wounds, and as disinfectants for hands, instruments, and hospital facilities. JAMES S. FRITZ

CRESS is any one of three green plants in the mustard family. They are used in salads and to garnish meats. The best-known cress plant is called *water cress* because it grows in water in sandy creek bottoms. It has smooth, bright-green leaves on long slender stems. *Garden cress*, or *peppergrass*, has a sharper taste than water cress. It grows in the Middle West. *Swedish cress*, sometimes called *upland cress* or *winter cress*, grows in Sweden. It is served as a vegetable there.

Water cress may be raised as a winter crop in greenhouses. It grows best in running water. Garden cress is usually planted in the early spring and harvested about six or seven weeks later. The cresses are rich in minerals, but are usually eaten in too small amounts to provide much food value.

Scientific Classification. Cresses belong to the mustard family, *Cruciferae*. Water cress is genus *Nasturtium*, species *N. officinale*. Garden cress is *Lepidium sativum*. Swedish cress is *Barbarea vulgaris*. S. H. WITTWER

See also MUSTARD.

CRETACEOUS PERIOD, *kree TAY shus,* is a period in the geologic time scale of the earth's history. Scientists believe that the Cretaceous Period began 130 million years ago. See also EARTH (table: Outline of Earth History).

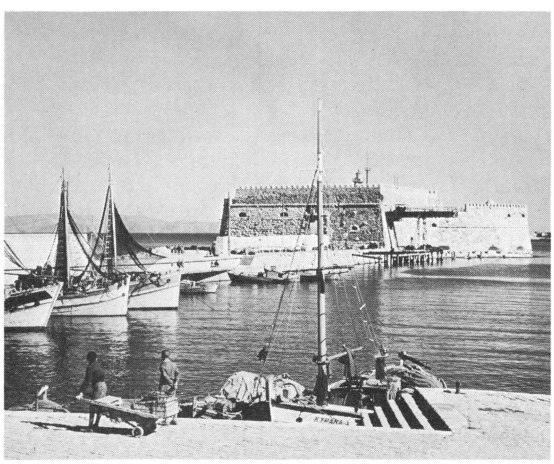
CRETE, *kreet*, is a Greek island in the Mediterranean Sea. It lies about 81 miles (130 kilometers) from the Greek mainland, and nearly twice as far from Turkey. For location, see GREECE (color map). Crete is the fifth largest island in the Mediterranean Sea. It is about 186 miles (299 kilometers) long and from 7 to 35 miles (11 to 56 kilometers) wide. Its coastline is 360 miles (579 kilometers) long. Crete covers 3,217 square miles (8,332 square kilometers). Crete and several nearby islands make up four *nomoi* (departments).

Mountain ranges run from one end of Crete to the other. Mt. Ida, Crete's highest peak, reaches 8,058 feet (2,456 meters) above sea level. Fertile valleys lie between the mountains. Crete has a mild climate, with a dry season during the summer, and rain in winter. The chief industries are farming, sheep and goat raising, and light manufacturing. Its principal exports include almonds, cheese, citrus fruits, olive oil, and wines.

Homer told of more than 100 cities in ancient Crete. But today, there are only three major urban areas, and all lie on the northern coast. These are Khaniá, the capital; Iráklion; and Réthimnon. There are no good natural harbors along the island's southern coast, and little commerce enters or leaves this area. Historians estimate that about 1,000,000 persons lived in ancient Crete. But today only 456,642 persons live there.

Crete and the Aegean islands were one of the areas in which ancient Mediterranean civilization reached advanced stages. But the island played relatively little part in ancient Greek history. Archaeologists have found remains of a Stone Age culture that flourished in Crete from about 10,000 B.C. to 3300 B.C. A Minoan, or Aegean, civilization followed the Stone Age culture, and lasted to about 1400 B.C. Crete achieved great advances in art, architecture, and engineering during this era (see AEGEAN CIVILIZATION).

In 67 B.C., Roman legions led by Pompey conquered Crete. In the following centuries, the Byzantines, the Venetians, the Ottoman Turks, the Egyptians, and other invaders ruled Crete. In A.D. 823, for example, Crete passed from the control of the Eastern Roman emperors to that of the Saracens. The Saracens built the capital of Candia (present-day Iráklion). The Byzantines expelled the Saracens in 861, and retained control for almost 400 years. In 1204, the Byzantine Emperor sold Crete to the Venetians. They held the island against both Genoese and Ottoman assaults until the Ottoman conquest of 1669.



Magnum

A Medieval Fort in Iráklion harbor stands as a reminder of the numerous tyrants who have invaded Crete.

Crete remained under Ottoman administration until the late 1800's. But most of the people were Christian in faith, Greek in speech, and pro-Greek in sentiment. Difficulties arose between the Cretans and the Turkish Moslem minority. These troubles intensified in the early 1800's, when Greek nationalism increased. The Ottoman Empire gave up control of Crete after the Greco-Turkish War (1897-1898). After the Ottomans left, Great Britain, France, Italy, and Russia agreed to allow Prince George of Greece to serve as governor of Crete.

The strong movement for union with Greece continued in the early 1900's. Crete became part of Greece soon after the Balkan Wars of 1912-1913. A Cretan leader, Eleutherios Venizelos, played a dominant role in Greek politics from that time until 1935. The Greek government fled to Crete after the German attack on Greece on April 6, 1941. The Greeks had to evacuate their government to Cyprus on May 31, when German airborne troops attacked Crete. Axis forces retained control of Crete until the surrender of May, 1945. After the war, the revival of exports and restoration of prosperity in Greece aided Cretan recovery. HARRY N. HOWARD

Related Articles in WORLD BOOK include:

Architecture (Greek)	Clothing (Ancient Times; pictures)	Knossos
Ariadne	Daedalus	Venizelos, Eleutherios

CRETINISM, *KREE tin iz'm*, is a condition, present at birth, that results when none or not enough of the thyroid hormone, *thyroxine*, is produced. Children suffering from this condition are called *cretins*. In these children, the thyroid gland may be absent or abnormally small. Or the gland may even be greatly enlarged but not functioning. The thyroid hormone influences growth. Therefore, a cretin does not show proper physical or mental growth. He has a large head, but short arms and legs. His face is broad and the bridge of his nose is flattened. His eyelids are puffed and his tongue protrudes between his lips. His pale, dry skin is cold and sometimes yellowish. Tooth and bone formation are delayed.

Doctors treat cretinism with thyroid extract, and begin treatment as soon as possible. When treatment is started early, the child's body often develops normally and brain development improves. BENJAMIN F. MILLER

See also THYROID GLAND; PARACELSUS, PHILIPPUS.

CRETONNE, *kree TAHN*, is a printed drapery fabric made of cotton, linen, rayon, or synthetics. It has a variety of weaves and finishes but is not glazed. Chintz is sometimes called cretonne, but cretonne is heavier with bolder designs. See also CHINTZ. KENNETH R. FOX

CREUSA. See MEDEA.

CREVASSE, *kreh VAS*, is a deep crack, or fissure, in an earth embankment or a glacier. Levees which are built to stop rivers from flooding sometimes leak water through crevasses. Huge crevasses, common on all glaciers, make it dangerous or even impossible to cross glaciers. See also GLACIER. WALTER H. BUCHER

CRÈVECOEUR, MICHEL-GUILLAUME JEAN DE (1735-1813), was a French-born essayist who

portrayed rural life in colonial America. His descriptions of the attitudes and hopes of the colonists persuaded many Europeans to settle in America.

Crèvecoeur was born near Caen, France. When he was 19 years old, he went to Canada to fight with the French during the French and Indian War. In 1769, he bought a farm near Chester, N.Y., and began his literary career.

Crèvecoeur wrote under the pen name of J. Hector St. John. He became best-known for 12 essays collected in *Letters from an American Farmer* (1782), written to an imaginary friend in England. The essays describe such scenes as children coming home from school during a snowstorm and families fleeing an Indian massacre.

Crèvecoeur supported the British during the Revolutionary War (1775-1783). In his *Sketches of Eighteenth Century America* (published in 1925, after his death), he accused the patriots of greed and the abuse of power in their struggle for independence. Crèvecoeur served as French consul to the United States from 1783 to 1790 and spent the rest of his life in France. DEAN DONER

CREWEL, or CREWELWORK, is a form of embroidery done with woolen yarn. Most crewel has designs stitched on a background of plain, sturdy cloth. The yarn, which consists of two woolen threads twisted together loosely, is also called crewel. Crewel can be used to create almost any design. Many crewel embroideries show flowers and vines arranged in graceful patterns. Crewel may include any embroidery stitch.

Historians believe the ancient Hebrews used crewel to decorate the Tabernacle, a tent in which they worshiped. During the A.D. 1000's or 1100's, French women stitched a famous crewel wall hanging called the Bayeux Tapestry (see TAPESTRY [Famous Tapestries; picture]). Crewel decorated curtains and upholstery in many American and English homes of the 1600's and 1700's. Today, many people stitch crewel pictures and other items. DONA Z. MEILACH

WORLD BOOK photo

Crewel is a wool yarn used for embroidery. When working with crewel, a person stitches the yarn onto a plain cloth, following the outline of a flower or other design printed on the cloth.

CRIB DEATH is the mysterious death of an apparently healthy baby. In most cases of crib death, the baby is found dead a few hours after being put to bed. The cause of death cannot be determined, even with an autopsy. Most of the victims are from 1 to 6 months old. Crib death is also called *sudden infant death syndrome.*

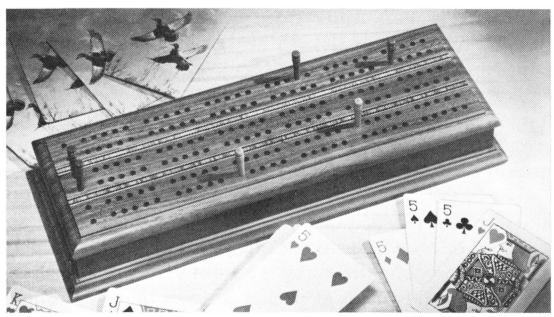
Some crib deaths have actually been observed. The baby suddenly turns blue, becomes limp, and stops breathing. It does not cry out or struggle. Attempts to revive the victim have succeeded in only a few cases.

Crib death occurs throughout the world. It kills about 10,000 babies a year in the United States. Crib death strikes more boys than girls, and it is more likely to kill premature babies than infants born after a full-term pregnancy. It occurs most often among the poor and in winter. Most victims are asleep when it strikes.

Researchers are working to determine what causes crib death. Some believe the cause may be an incompletely developed nervous system that cannot control breathing during sleep. Others are investigating allergies and viruses as possible causes. MARIE VALDES-DAPENA

CRIBBAGE is a card game for two, three, or four persons. Each player keeps his score on a *cribbage board,* using two *pegs.* The object of the game is to *peg* (score) 121 points. But the game may also be set at 61 points.

When two persons play, they *cut* (divide) the pack



Brown and Bigelow

In a Cribbage Game, each of the players keeps his own score by moving two pegs on the special cribbage board.

to decide who will deal. The one who gets the lower card deals six cards to his opponent and six to himself. Each player then places two cards face down. These four cards form the *crib,* which is used at the end of the hand. The nondealer cuts the rest of the cards and turns up the top card of the lower part of the pack. This card is the *turnup* or *starter.* If it is a jack, the dealer pegs 2 for *his heels.*

The nondealer begins by laying down a card and calling its value. The dealer then lays down a card and adds its value to the first card. They continue until the value of the cards totals 31. The player who reaches 31 pegs 2 points. If a player cannot lay down a card without going beyond 31, he must say "go." His opponent then pegs 1 for *go* after playing as many cards as he can without passing 31. Whenever a *go* occurs, the opponent of the one who last played begins a new count. When each player has used all his cards, he pegs the total points for his hand.

In scoring, face cards count 10, the ace counts 1, and the others count according to their spots. Points are scored both during the play and at the end of the hand. Each combination of 15 points and each pair counts 2 points. A *run* of three or more cards in sequence scores 1 for each card. Three cards of a kind count 6 and four of a kind count 12. At the end of the hand, the nondealer counts his score first. Each player includes the

turnup in the count of his hand. A player holding a jack of the same suit as the turnup pegs 1 for *his nobs*. The crib belongs to the dealer, and he adds its value to his score. LILLIAN FRANKEL

CRICK, FRANCIS H. C. (1916-), is a British biologist. He shared the 1962 Nobel prize in physiology or medicine with biologist James D. Watson and biophysicist Maurice H. F. Wilkins. Crick and Watson built a model of the molecular structure of *deoxyribonucleic acid* (DNA), the substance that transmits genetic information from one generation to the next. The model, resembling a twisted ladder, is called the *Watson-Crick model*. See NUCLEIC ACID; HEREDITY (Genetics).

Originally a physicist, Crick helped develop radar during World War II. In 1949, he began research work in molecular biology at Cambridge University. Born in Northampton, England, he studied at London and Cambridge universities. IRWIN H. HERSKOWITZ

See also BIOLOGY (picture: Highlights).

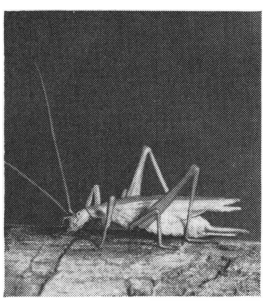
CRICKET is a kind of jumping insect related to grasshoppers. Crickets differ from grasshoppers in having prominent feelers at the tip of the abdomen. Crickets' wings lie flat over each other on top of their backs. Some crickets are wingless. The slender antennae are much longer than the body in most kinds of crickets. The *ovipositor*, an organ from which the eggs are laid, is usually slender and cylindrical.

The best-known crickets are the *house cricket* of Europe and the *common*, *black*, or *field cricket* of America. These blackish or brownish insects are about 1 inch (2.5 centimeters) long. The *tree cricket* is a light yellow-greenish in color. It spends most of its life in trees and in bushes. The tiny *ant-loving crickets* are wingless and as broad as they are long. They live in ants' nests. *Mormon crickets*, *camel* (*cave*) *crickets*, *mole crickets*, and *Jerusalem crickets* are not considered true crickets (see MOLE CRICKET; MORMON CRICKET).

Only the male cricket produces sound. But both sexes have hearing organs located in their front legs just below the knee. Crickets remain in sheltered places during the day, and go out at night for food. They eat many foods including grain, remains of other insects, woolen articles, and bookbindings. In autumn, most crickets lay their eggs in soil. The eggs hatch the following spring. In China and Japan, people keep singing crickets in cages as pets.

Scientific Classification. Crickets are in the order *Orthoptera* and the cricket family, *Gryllidae*. URL LANHAM

See also ORTHOPTERA; WEATHER (picture: Weather Facts); INSECT (picture: The "Ears" of a Cricket).

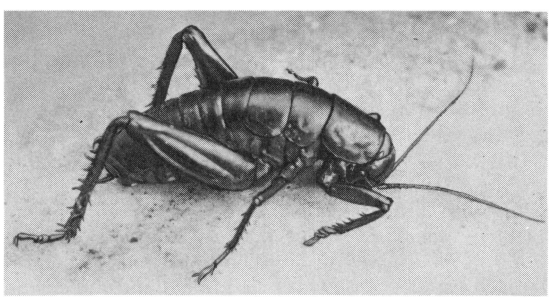


Cornelia Clarke

The Tree Cricket chirps louder than most other crickets.

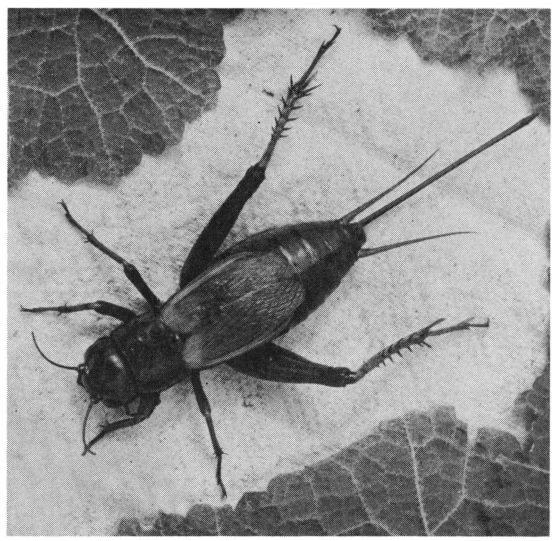
USDA

The European House Cricket grows about 1 inch (2.5 centimeters) long.



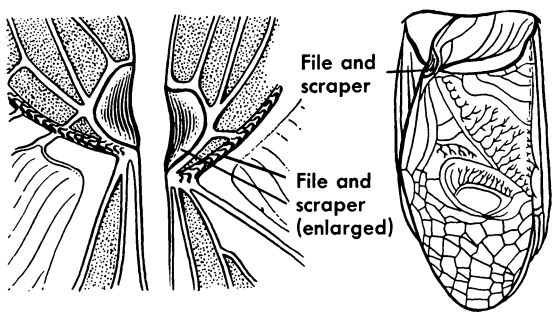
Cornelia Clarke

The Camel Cricket Lives in Caves and Hollow Trees.



Foldes, Black Star

The Common North American Field Cricket, *above,* is known for its song. It grows about 1 inch (2.5 centimeters) long.



The Organs with Which the Cricket "Sings." At the right are shown the cricket's upper wings, folded along its back so that the right wing nearly covers the left. At the left, portions of the wings are shown separated, with the sound-producing organs enlarged. Each wing has a "file," or thickened vein with crossridges, and a "scraper," or hard, sharp-edged portion. The scraper of either wing may be rubbed against the file of the other wing to produce the mating call.

CRICKET is a game played with a bat and a ball by two 11-man teams. It is one of the most popular games in England and in several other Commonwealth countries. Baseball, the "national game" of the United States, was developed from cricket. In both games, one player pitches or bowls a ball and an opposing player tries to hit the ball with a bat and score runs. The team that scores the most runs wins the game.

Cricket players play the game on a level, oval-shaped field of grass. The action centers around two *wickets*. Each wicket consists of three short stumps with two *bails* (sticks) connecting the tops of the stumps. A member of the fielding side called the *bowler* stands behind one of the wickets. He *bowls* (delivers) the ball with a stiff-armed motion at the opposing wicket, trying to knock off one of the bails. The ball usually bounces off the ground before hitting the wicket. The *batsman* or *striker* stands at the far wicket facing the bowler. He tries to hit the ball with a long flat-sided bat. If he misses the ball and it knocks a bail off the wicket, he is out. If he drives the ball into the field, he and the *nonstriker* (a teammate standing at the opposite wicket) may try to score a run. If the batsmen run to the opposite wickets before a member of the fielding team knocks off a bail with the ball, they score a run for their team. The batsmen score a run each time they both safely reach the wickets. Sometimes, the two batsmen can run back and forth between the two wickets scoring several runs before the ball is brought close enough to the wicket to put them out. A major cricket match may last from three to five days, and each team may score hundreds of runs.

Sir Donald George Bradman, the contributor of this article, is an Australian and one of the greatest batsmen in cricket history.

Cricket players wear peaked caps, white or cream trousers and open-necked shirts, and white spiked or crepe-soled boots. Batsmen and wicketkeepers wear protective leg pads and gloves.

Cricket Field and Equipment

The Field may vary in size, but most official fields are about 450 feet (137 meters) wide and 500 feet (150 meters) long. The wickets stand 22 yards (20 meters) apart in the center of the field. The area between them is called the *pitch*. The *bowling crease* is a line drawn through the wicket that extends 4 feet 4 inches (132 centimeters) on either side of the center stump. At each end of the bowling crease, lines called *return creases* are marked to the rear of the wicket. The return creases are marked only a short distance back, but they are considered actually to extend all the way to the end of the playing field.

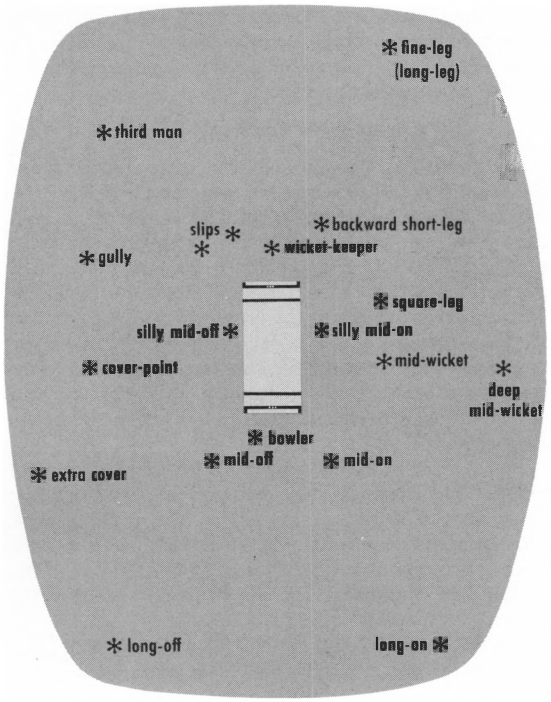
The bowler must bowl the ball between the return creases. The *popping crease* is parallel to the bowling crease and 4 feet (122 centimeters) in front of the wicket. The popping crease is marked 8 feet 8 inches (264 centimeters) long, but it actually extends to either side of the cricket field. A batsman is required to step inside of the popping crease to score a run.

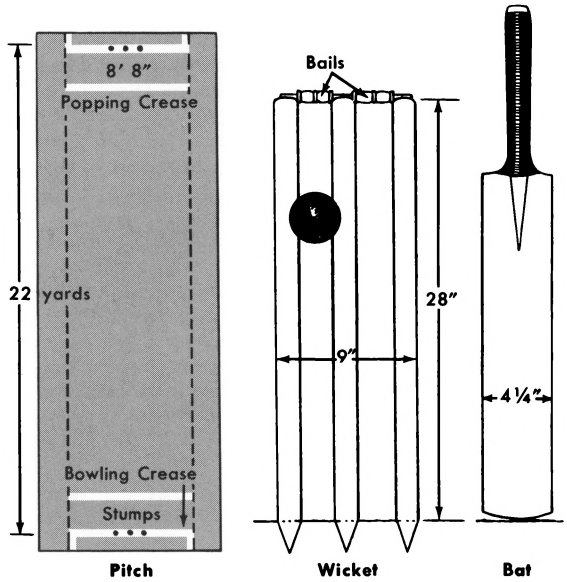
The Wickets are 9 inches (22.9 centimeters) wide, and consist of three stumps 28 inches (71.1 centimeters) high. The stumps are close enough together so the ball cannot go between any two of them. The bails are $4\frac{3}{8}$ inches (11.1 centimeters) long and rest in grooves on the tops of stumps. They do not extend beyond the outer edges of the stumps, and do not rise more than $\frac{1}{2}$ inch (13 millimeters) above them.

Bat and Ball. The rules of cricket do not specify the material to be used in making a cricket ball. How-

Sport and General

Cricket Players must have quick reflexes. The fielder, center, cannot stop the ball as it bounces past. The batsmen race back and forth between the wickets, trying to score as many runs as possible before theball is fielded and returned.





Cricket Field and Equipment. The fielding positions, *left*, are those often used for a right-handed batsman. The positions vary according to the skills of the batsman and the bowler. The pitch is marked with batting and bowling creases. The stumps are close together so the ball cannot go between them. Bats vary in length.

ever, a cricket ball usually has a cork core wrapped with twine and a leather cover. The ball must be between $8\frac{13}{16}$ and 9 inches (22.4 and 22.9 centimeters) in circumference, and it must weigh between $5\frac{1}{2}$ and $5\frac{3}{4}$ ounces (155.9 and 163 grams).

The bat cannot be more than 38 inches (96.5 centimeters) long nor more than $4\frac{1}{4}$ inches (10.8 centimeters) wide at any point. It has a round handle at one end. The rest of the bat is a flat, bladelike hitting surface. Young players should use a small bat so that they can swing it easily.

Cricket Rules

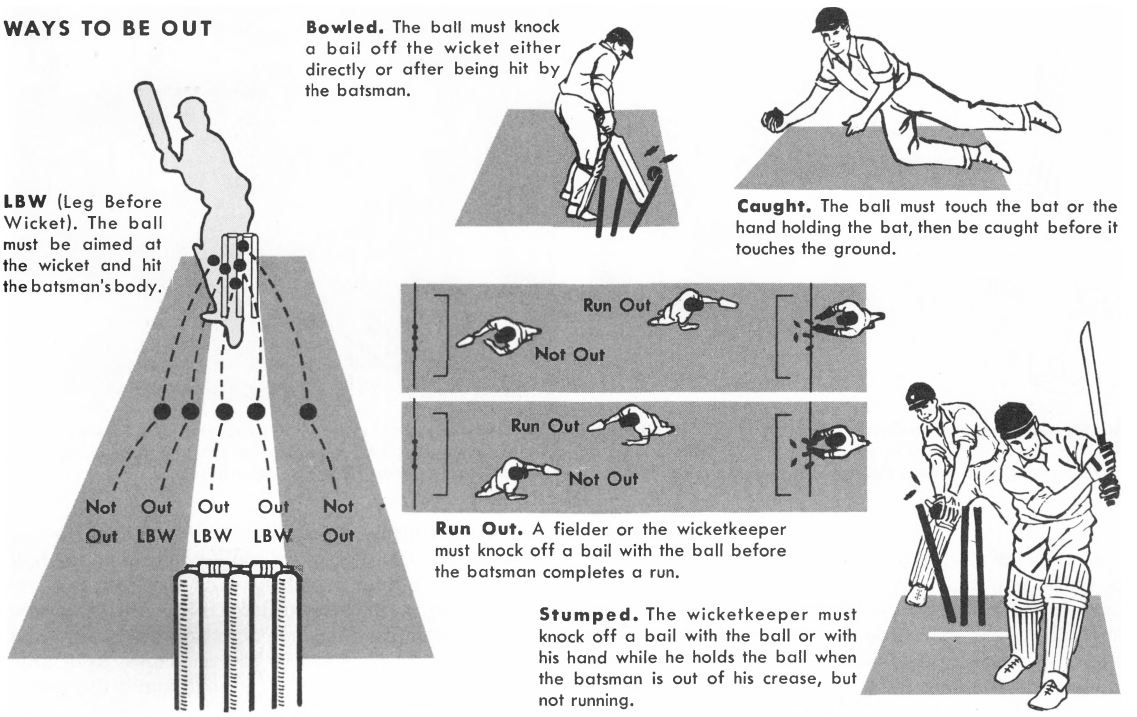
A cricket match may consist of one or two innings. Important matches are played in two innings. A team's innings ends when 10 of its 11 men have been put out. Team captains flip a coin to decide who will bat first. In a match of three days or more, a captain whose team batted first and is ahead by more than 150 runs after the other team has batted may decide that his team has enough runs to win. He may order the other side to *follow-on* (bat its second innings immediately after its first innings). If the other team then scores more runs and takes the lead, his team can take the field to bat in its second innings.

The team that has the most runs wins. But the score is sometimes given in the number of *wickets* (outs). In a two-innings game, a team that scores more runs than the other team after the other team has batted twice wins the game without finishing the last innings. That team wins by a certain number of wickets. For example, if only four men have been put out, the team wins by six wickets because six men have not been put out. A team may also win by *innings*. For example, if a team batting first and third scores fewer runs than the other team scored in one innings, the second team wins by one innings without batting a second time.

Scoring. Most runs are scored by running from one wicket to the other. Batsmen also score runs when they hit the ball out of bounds. A *boundary, four* (four runs) occurs when the batsman hits the ball and it bounces out of bounds. A *boundary, six* (six runs) occurs when the batsman hits a ball that goes over the boundary before it touches the ground.

Runs called *extras* may also be scored by bowling. Extras are scored on *byes, leg byes, wide balls*, and *no balls*. A bye is a run scored from a ball that passes the batsman and the stumps without touching either of them. A leg bye is a run scored where a ball strikes the batsman anywhere but on the hand. In byes and leg byes, the batsman may score runs until the ball is brought back to the wicket. When a bowler delivers a *wide ball* (one that goes outside the return creases), the opposing team scores a run. If the bowler throws the ball, or if he does not have his front foot behind the bowling crease when he bowls, it is ruled a no ball.

Outs. There are several ways to put out a batsman. The most direct way is to bowl the bail off the wicket. The batsman is also out if (1) he hits a ball that is caught by a fielder or lands in a fielder's clothing without touching the ground; (2) he touches the ball with his hands while it is in play; (3) he hits the ball a second time except to keep it from hitting the wicket; (4) he *breaks the wicket* (knocks off the bail) with his bat, clothing, or any part of his body; (5) he stops the ball with his body to prevent it from hitting the wicket



(called *Leg Before Wicket*, or *LBW*); (6) he tries to prevent or willfully prevents a player from fielding or catching a ball; (7) he tries to score and the wicket is broken before he crosses the popping crease; or (8) he steps outside the crease when not trying to run, and the wicket is broken by the wicketkeeper with the ball in his hand, without any other fielder having touched the ball (called *stumping*).

Umpires control the game and make all decisions. One umpire stands behind the bowler's wicket to give decisions on whether the striker is out LBW or caught, and to rule on run outs at his end. A second umpire stands at 90 degrees to the striker's wicket to rule on a stumping or a run out at his end. The umpire at the bowler's end must also decide whether the ball is in play. The ball is in play from the moment the bowler begins his run up to the crease. The ball is *dead* (not in play) when the umpire judges that (1) it is finally in the hands of a wicketkeeper or bowler, (2) it has crossed the boundary, (3) it has lodged in the clothing of a batsman or an umpire, or (4) it has been called "lost." The ball is also dead if the umpire calls unfair play or if he suspends play because a player has been hurt or when a player is out for any reason.

Cricket Teams

The Batting Side. The team captain decides the order in which his team's batsmen will bat. When each batsman is out, a teammate replaces him until 10 men are out. One batsman always remains *not out*. At major cricket grounds, members of the batting side who are not at the wickets usually sit in balconies in the grandstand waiting their turn at bat.

The Fielding Side is made up of the bowler, the wicketkeeper, and nine other fielders. The other fielders' positions vary in name and location. The most common positions are shown in the diagram of the field that appears in this article. The players near the pitch move from one side of the field to the other, according to whether the batsman is left or right handed.

After the bowler has delivered six balls (eight in Australia), another bowler bowls at the opposite wicket. The striker then becomes the nonstriker, and his teammate at the other wicket becomes the striker. This is an *over*. The fielders then move to new positions.

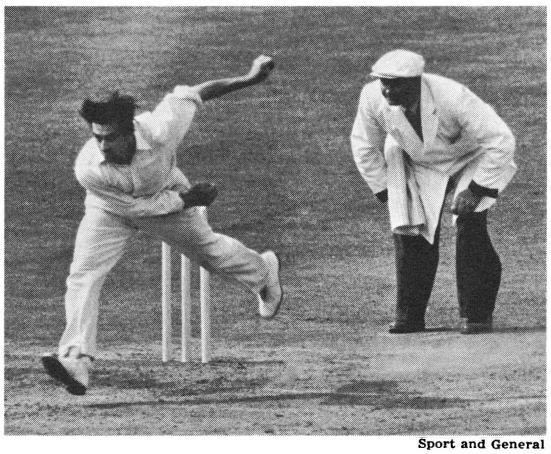
Batting

A right-handed batsman should hold the bat with his left hand near the top of the handle with his knuckles facing the same way as the hitting side of the bat. His right hand should be close below the left.

A right-handed batsman should stand with his feet about 6 inches (15 centimeters) apart, one on each side of the popping crease. The batsman's grip and stance should be easy and relaxed, and his weight should be evenly balanced. His left shoulder should point toward the bowler, and the top of the bat handle should rest against the inside of his left thigh. The bottom of the bat should be behind his right instep. The position is reversed for left-handed batsmen.

The Batting Strokes may be divided roughly into two categories, *forward play* and *back play*. Each may be used defensively or to attack and try to score runs. For both strokes, the batsman swings the bat back in a movement called the *back-lift*, then forward and down past his feet, then up to meet the ball.

The Bowler looks over his shoulder at the point on which he wants to bounce the ball. He then brings his arm over, keeping it stiff to prevent jerking, and follows through after releasing the ball.



Sport and General

Skillful Bowlers deliver the ball at varying speeds. They try to confuse the batsman by changing speeds and making the ball change direction either before or after it bounces.

On a forward stroke, the batsman pushes his left foot forward as near as he can to the path of the ball. When the ball is bowled slowly, the batsman may take two or three short steps toward the ball, rather than one long step. He should swing the bat forward as close to his left leg as possible. A forward stroke is best for a ball bouncing near enough to the batsman to be hit on the *half-volley* (as it comes off the ground), to protect the wicket and to drive the ball into the field. To protect the wicket, he may start the swing farther back.

The back stroke is basically a defensive stroke. It is better for a ball that bounces far enough from the wicket for the batsman to be able to see which way it will bounce. The batsman brings his back leg into the path of the ball, keeps his left elbow up, and keeps his head over the point where the ball will meet the bat. There should be no space for the ball to pass between the bat and his body. By putting more power into the stroke, the batsman can drive the ball into the field.

Good batsmen usually swing the bat forward in a straight line to meet the ball. However, batsmen can score many runs by *cutting* or *hooking* (swinging the bat at an angle to the path of the ball), and driving the ball to their *on-side* (near side of the wicket).

In playing back, the batsman can use a wide variety of strokes, according to the length and direction of the ball. One of the great arts of batsmanship is to be able to hit between two fieldsmen, giving them little chance to play the ball.

In Running, the striker usually calls for a run when he thinks he and the nonstriker can make one or more runs. But when he hits the ball behind his crease, the nonstriker calls for a run. The nonstriker should always be *backing up* (moving away from the wicket and his own crease) and ready to run.

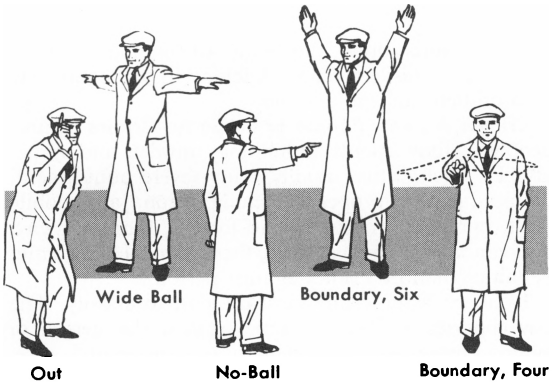
The Batsman guards the wicket. He uses the forward stroke, *left*, for a ball that has just bounced, trying to hit it into the field. On the back stroke, *right*, the batsman simply tries to keep the ball from hitting the wicket.

Bowling

A bowler does not jerk or throw the ball. He does not bend or straighten his arm during the delivery. According to the official rules, he must have one foot behind the bowling crease when he releases the ball. Under an experimental rule introduced in 1965, he must have his front foot on or behind the batting crease. The length and direction of the bowl are the two most important points in bowling. A good length bowl bounces only a few feet in front of the batsman so he cannot easily hit it.

Good bowling is based on coordinated body, arm, and shoulder motion. The run-up to the bowling crease is designed to give the bowler enough momentum and balance to bowl the ball at the *pace* (speed) he desires. Then, at the final stride, a right-handed bowler's left shoulder should point toward the batsman. When his left foot has swung forward, the bowler's right shoulder should move forward and point in the direction that the ball will travel. The bowler continues his arm motion after releasing the ball to gain the most power.

His wrist must be loose. His hand is cocked back before he bowls the ball, and the hand pivots on the wrist in the delivery swing. This action makes the ball travel much faster than the arm. Bowlers can make a ball *curve* (change direction in flight) or *break* (change direction as it bounces) by controlling the ball's speed and by gripping and spinning the ball in special ways.



The Umpires stand at either end of the pitch. They use arm signals to indicate their decisions to players and spectators.

History

Cricket was probably first played in the 1300's in England, and became a major sport there in the 1700's. By the 1800's, cricket had spread to Australia, India, New Zealand, South Africa, and the West Indies.

The first printed rules appeared in 1744. Since 1788, cricket rules have been made and published in England by the Marylebone Cricket Club (MCC). Modern cricket style and method of play were largely created by W. G. Grace, a great English player of the late 1800's.

International matches called *test matches* began between England and Australia in 1877. Test matches are now played by England, Australia, India, New Zealand, Pakistan, the West Indies, and South Africa.

Since 1882, the test match between England and Australia has been played for *The Ashes*. The term was first used after Australia had beaten England in London. After that defeat, an English newspaper printed a mock death notice of English cricket. The last words were "The body will be cremated [burned] and the ashes taken to Australia." A year later, an English team went to Australia and defeated the Australians. Two Australian women burned a bail, put the ashes in a small urn, and presented it to the English team manager. The urn was later sent to Lord's, a major cricket ground in London. It is still kept there, no matter which country wins *The Ashes*.

Each country holds a nationwide championship series for the first class cricket teams. This series is called the County Championship in England, the Sheffield Shield in Australia, the Plunket Shield in New Zealand, the Currie Cup in South Africa, and the Ranji Trophy in India. SIR DONALD GEORGE BRADMAN

CRILE, GEORGE WASHINGTON (1864-1943), gained fame as a surgeon. His contributions to the development of surgery included studies on shock, hemorrhage, blood transfusion, surgical treatment of high blood pressure, and a nerve-block system of anesthesia. He had wide interests and wrote such books as *Diseases Peculiar to Civilized Man* (1934); *The Phenomena of Life* (1936); and *Intelligence, Power and Personality* (1941).

Crile was born in Chili, Ohio. He received his medical degree from Western Reserve University (now Case Western Reserve) in 1887 and taught there intermittently from 1893 to 1924. Crile founded the Cleveland Clinic Foundation in 1921. NOAH D. FABRICANT

CRIME

CRIME is a term that refers to many types of misconduct forbidden by law. Murder—also called *homicide*—is a crime in all countries. In the United States, stealing a car is a crime. So is being drunk and disorderly in public, resisting arrest, possessing or selling illegal drugs, and using the mails to cheat someone. Other crimes include failing to file an income tax return, appearing nude on a public street, drunken driving, and bank robbery.

The list of acts considered crimes is constantly changing. For example, people in the United States no longer are charged with witchcraft, though many were accused of that crime in colonial Massachusetts. Today, it is becoming a serious crime to pollute the air and water. Pollution caused few problems and received little attention in colonial days. In England during the 1700's, it was not a crime for a person to steal money entrusted to his care by an employer. Today, this type of theft, called embezzlement, is a crime.

From a legal standpoint, a crime is a violation of the *criminal law*. Such law deals with actions considered harmful to society. On the other hand, most harmful acts against another person are violations of the *civil law*. Some overlapping occurs in this classification. For example, murder and rape are committed against individuals, but the law considers them crimes because they

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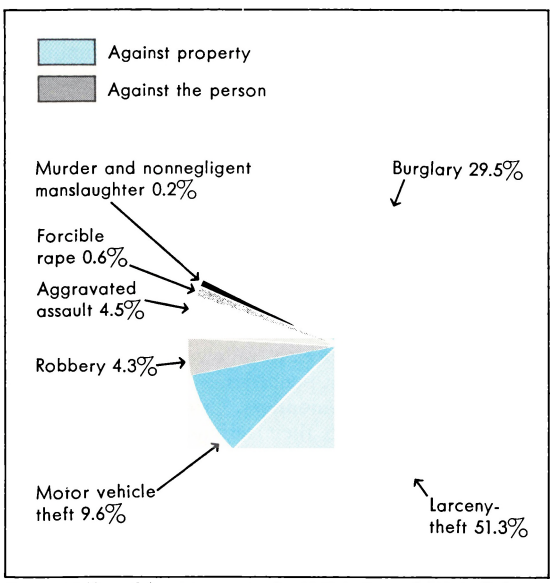
MAJOR CRIMES IN THE UNITED STATES

Total major crimes reported to the police in 1974—10,107,000



Source: *Uniform Crime Reports for the United States*, 1974 Preliminary Annual Release, FBI.

This chart is based on the Crime Index compiled by the Federal Bureau of Investigation (FBI). The index covers seven crimes that the FBI considers serious offenses likely to be reported most accurately to the police. Three offenses are crimes against property, and the remaining four are crimes against the person.

threaten society. For this reason, a crime is regarded as an offense against the state.

An act is viewed as a crime if enough evidence exists to make a policeman, a prosecutor, or a judge believe that a violation of the criminal law has taken place. However, the law does not consider an accused person a criminal unless a judge or a jury finds him guilty. A criminal may be imprisoned or receive some other punishment, according to the laws of the community in which the crime was committed or the trial was held.

A person who commits any crime is called a criminal. But the term is sometimes used only for a person who commits such a serious crime as murder or robbery. At other times, the term refers only to habitual criminals.

The study of criminal behavior is called *criminology*, and experts in this field are called *criminologists*. Criminologists study crime and criminals for various reasons. They may try to determine where, when, and why different types of crime occur. They also seek the relationships between criminals and the victims of crimes, as well as the most effective ways to prevent crime. See CRIMINOLOGY.

Types of Crimes

Crimes may be classified in various ways. For example, they sometimes are grouped according to the seriousness of the offense. For statistical purposes, many governments divide crimes into offenses against people, against property, and against public order or public morality. Some social scientists classify crimes according to the motives of the offenders. Such crimes might include economic crimes, political crimes, and crimes of passion. Other important kinds of crime include organized crime and white-collar crime.

Crimes are often divided between acts that most people would consider evil and acts that lawmakers decide should be regulated in the interest of the community. The first group includes such major crimes as arson, assault, breach of the peace, burglary, kidnaping, larceny, murder, rape, and robbery. Most of these crimes have long been forbidden by the English *common law*, the source of criminal law codes in the United States (see COMMON LAW). The second group includes crimes of a rapidly growing urban society. These crimes include violations of income tax laws, liquor control regulations, pure food and drug laws, and traffic laws. Crimes in the first group usually involve severe punishments. Crimes in the second group are generally punished by fines, notices to follow the court's orders, or other relatively light penalties.

Felonies and Misdemeanors. Crimes are frequently classified according to their seriousness as *felonies* or *misdemeanors*. Generally, felonies are more serious than misdemeanors. Under the federal criminal law system, felonies are crimes for which the punishment is death or imprisonment for more than a year. A misdemeanor is punishable by a fine or by imprisonment for less than a year. In a number of states, persons convicted of felonies are sent to state prisons. Those guilty of misdemeanors serve their sentence in city or county jails or houses of correction.

The classification of crimes as felonies or misdemeanors is inexact and not very useful. In addition, not all courts draw the same distinction between felonies and misdemeanors. A felony in one court may be a misdemeanor in another.

Crimes Against People or Property. Crimes against people include assault, kidnaping, murder, and sexual attacks. Such crimes usually bring severe punishment. Crimes against property include arson, automobile theft, burglary, embezzlement, forgery, fraud, larceny, and vandalism. In most cases, these crimes carry lighter penalties than do crimes against persons.

Robbery is the crime most difficult to classify. The law considers robbery a crime against the person or against property, according to the individual case. Robbery may involve simply taking property from another person. But a personal encounter occurs between the robber and his victim, and it may include violence and bodily harm, especially in muggings or other strong-arm robberies. Robbery is probably the crime most people have in mind when they speak of "crime in the streets."

Crimes Against Public Order or Morality include disorderly conduct, gambling, prostitution, public drunkenness, and *vagrancy* (having no permanent residence or visible means of support). These offenses generally involve lighter penalties than do crimes against people or property.

Criminologists question whether some offenses against public order or morality should be considered crimes. For example, many experts believe that habitual drunkenness is a medical problem and that the offender should be given medical help instead of being put in jail. There is also widespread disagreement about whether certain practices hurt society and should be considered crimes. Such acts include gambling, use of marijuana, and homosexuality between consenting adults.

Organized Crime consists of large-scale activities by groups of gangsters or racketeers. Such groups are often called the *crime syndicate* or the *underworld*. Organized crime specializes in providing illegal goods and services. Its activities include gambling, prostitution, the illegal sale of drugs, and *loan-sharking* (lending money at extremely high rates of interest). Many of these activities are often called *victimless crimes* because both the buyer and the seller take part in them willingly.

Most activities of the crime syndicate are not reported to the police. People who use the illegal services try to avoid the police. When the crime syndicate invades a legitimate business or labor union, it uses terror, blackmail, and other methods to keep people from going to the police. Even when the illegal activities are discovered, prosecutors have difficulty convicting the gangsters because of the lack of reliable witnesses. In addition, the syndicate frequently tries to bribe witnesses or law officers and sometimes succeeds in doing so. The syndicate also furnishes bail money and lawyers for members who are arrested.

Gangsters have two main goals—money and power. No one really knows how much they have of each. But investigations have shown that organized crime is a multimillion-dollar business and that gangsters have considerable political control.

White-Collar Crime originally included only criminal acts committed by businessmen and professional people while earning their living. The term referred to such

crimes as stock market swindles and other kinds of fraud. Today, the term covers such acts as cheating in the payment of taxes—which may or may not be done in connection with one's business. It may apply to petty thefts by employees, as well as to million-dollar stock market swindles. It could also include a service station owner's charging for an automobile repair he did not actually make, or a physician's billing a patient for services he did not perform.

Many consumer protection laws are aimed at white-collar crime. These laws regulate business and professional activities to protect consumers. During the 1960's and early 1970's, consumer protection became one of the fastest-growing fields of criminal law. In the United States, for example, the federal government developed a number of new rules and penalties. They were intended to control air and water pollution, to prevent fraudulent trade practices, and to alert people seeking loans about actual interest costs. See CONSUMER PROTECTION.

The Extent of Crime

Crime is one of the world's oldest social problems. Almost every generation has felt itself threatened by increasing crime and violence. However, no country has yet developed completely reliable methods for measuring the volume and trend of crime.

Crime in the United States. The Federal Bureau of Investigation (FBI) serves as the main source of information about crime in the United States. The FBI has maintained national crime statistics only since 1930. Reporting procedures between 1930 and 1958 gave only a very inexact national estimate of crime. Since 1958, improved reporting methods have provided increasingly reliable figures. The FBI receives monthly and annual crime reports from law enforcement agencies throughout the country. It summarizes and publishes this information in quarterly reports and in its annual *Uniform Crime Reports for the United States.*

The FBI's Crime Index measures the amount and distribution of serious crime in the United States. The index covers seven crimes that the FBI considers serious offenses likely to be reported most accurately to the police. Four of these offenses are classified as violent crimes—aggravated assault, forcible rape, murder and nonnegligent manslaughter, and robbery. The other three are crimes against property—burglary, larceny-theft, and motor vehicle theft.

FBI reports show that the U.S. crime rate per 100,000 population has gone up almost every year since 1958.

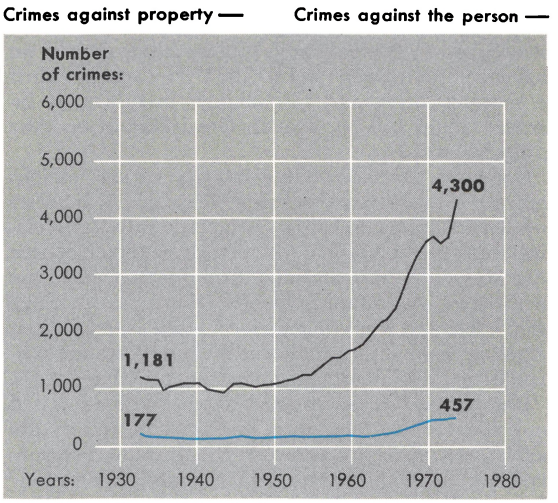
— MOST FREQUENT ARRESTS IN THE UNITED STATES —

Total arrests in 1973—9,027,700

Offense Charged	Number of Arrests	Rate of Arrests per 100,000 Population
Drunkenness	1,599,000	762
Drunken driving	946,800	451
Larceny	858,900	409
Disorderly conduct	720,400	343
Narcotics violations	628,900	300
Burglary	434,000	207
Simple assault	383,700	183
Liquor law violations	272,000	130
Runaways	265,600	127
Aggravated assault	208,100	99

Source: *Uniform Crime Reports for the United States, 1973,* FBI.

CRIME RATE IN THE UNITED STATES
Rate per 100,000 population



Source: Federal Bureau of Investigation.

From 1960 to 1974, the crime rate for reported serious offenses rose 201 per cent. But it is difficult to determine how much of this increase actually occurred and how much resulted from improved crime-reporting procedures. In 1960, slightly more than 3 million serious crimes were reported in the United States. About 10 million serious crimes were reported in 1974. About 90 per cent of the offenses reported in 1974 were for the three crimes against property. Crimes of violence against the person accounted for the remaining 10 per cent.

Many people believe that most arrests are made for serious crimes. But such crimes account for about one-fifth of all the arrests each year in the United States. Three relatively minor offenses—drunkenness, disorderly conduct, and vagrancy—account for about one-fourth of all the arrests.

Crime in Other Countries. Countries vary greatly in their definition of crime and in the reliability of their crime statistics. Conditions that affect the amount of crime also vary from one country to another. Such conditions include the proportion of people living in cities, the proportion of young and old people in the population, and the degree of conflict among various cultural, economic, and racial groups.

One basis of comparison is the homicide rate in various countries. Most murders are reported to the police, though their definition may vary. In 1966, the United States reported 5.6 homicides per 100,000 population. This murder rate was more than twice that of Canada, Japan, and Sweden and about five times as great as the rate in Great Britain.

A comparison of the changing crime rates within a country proves more valuable than comparing the rates of two or more countries. Studies show that crimes against property are rising rapidly in most countries, as they are in the United States. From 1955 to 1965, for example, crimes against property increased more

than 100 per cent in France, Great Britain, Italy, and Norway. During that same period, crimes against property rose almost 200 per cent in the United States and more than 200 per cent in Finland, The Netherlands, Sweden, and West Germany. Violent crimes showed no definite pattern from 1955 to 1965. The rate declined in some countries and rose slightly in others. It increased about 150 per cent in Great Britain and the United States.

Comparisons of the crime rates of various nations indicate that increases in crime accompany increases in the rate of social change. The crime rate stays relatively stable in traditional societies where people believe their way of life will continue. Crime rates tend to rise in societies where rapid changes take place in where people live and what they do for a living—and in their hopes for their future well-being. Crime rates are particularly high in industrial nations that have large cities.

Unreported Crime. Statistics about crime are based on complaints to the police, offenses observed by the police, and arrests of suspects. Much crime goes unreported. In 1966, the President's Commission on Law Enforcement and Administration of Justice made a national survey of 10,000 families in the United States. The survey asked whether any family member had been a victim of a major crime within the past year. The survey showed that over twice as many offenses occurred than had been covered by police statistics. Many other types of crimes also remain unreported, including offenses against businesses, organizations, and public agencies and against public order and morality.

In the early 1970's, the U.S. Bureau of the Census began annual surveys of the general population to improve the statistical information on national crime rates. Such surveys will show whether the increase in reports of crime has resulted from improved crime-reporting methods or a rise in the actual number of offenses.

The Cost of Crime to its victims is impossible to determine accurately. Any estimate based on existing data will probably underestimate the cost considerably. For example, a dishonest business scheme may cost consumers or investors millions of dollars, but no records are kept of such losses. Similarly, there is no way to determine the profits to the crime syndicate of gambling, loan-sharking, narcotics sales, and prostitution.

The cost of crime prevention and control measures is also difficult to determine. Expenditures for law enforcement and criminal justice agencies in the United States total more than $4 billion annually. However, these agencies also deal with many noncriminal matters, such as traffic control. Perhaps only 10 to 15 per cent of police costs can be directly charged to crime control. In addition, most courts handle both criminal and civil cases.

Causes of Crime

People commit crimes for various reasons. For example, many persons steal things they could not obtain otherwise. Others, such as drug addicts, steal to get money to buy narcotics or other things they need. Some shoplifters steal for excitement, but others do so to stretch the family budget. Many automobile thieves take cars for joy-riding, but others strip down the stolen autos and sell them. Many embezzlers take money from their employers to meet a personal emergency, intending to return the money.

The motives also vary in crimes of violence. A robber may kill his victim to avoid detection. Some gangsters torture people to obtain money. A man may beat his wife in a fit of rage during a quarrel.

Biological and Psychological Explanations. Many studies have sought to explain crime. Most of them compare habitual criminals with persons who have not been convicted of crimes to try to find important differences between the two groups. Since the late 1800's, for example, researchers trained in the biological sciences have searched for physical differences. Such studies involve differences in body type, the pattern of brain waves, and the formation of genes. None of these studies has proved that criminals have any physical traits that make them different from other people.

Research by psychiatrists and psychologists stresses personality differences resulting from experiences in childhood or later. This research shows that many people who became criminals were neglected by their parents or were given harsh or uncertain discipline. Such treatment left them insecure and demanding in their relations with others. Their own wants made them ignore the needs or rights of others. But researchers have had difficulty making a direct connection between emotional needs and crime because many people with emotional problems find acceptable ways of solving them.

Social Conditions and Crime. Sociologists have conducted crime studies that focus on the neighborhood and community rather than on the individual. Some of these studies deal with how a person becomes committed to a career of crime, and others try to explain differences in crime rates.

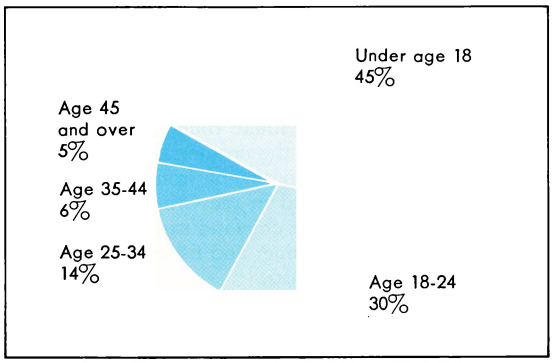
The highest crime rates occur in the most deprived sections of large cities. These are the areas where it is most difficult to train children to become law-abiding citizens. Such areas have the highest rate of broken homes. Even in many homes where both parents are present, emotional conflicts and health and financial problems affect family life. Slum areas usually have the poorest schools and the highest unemployment rates. These neighborhoods have much run-down, overcrowded housing and poor recreation facilities.

For many young people, the excitement of the streets provides the principal escape from boredom and seemingly unsolvable problems. These streets are also the scene of much vice and crime—gambling, prostitution, narcotics use and sale, public drunkenness, and acts of violence. Law enforcement in the inner city is difficult, partly because too few policemen patrol the neighborhoods. In addition, many of the people fear the police and refuse to cooperate with them. All these factors increase the possibility that a person who lives in a slum will commit criminal acts.

Most residents of the high-crime slum areas of many large cities are Negroes or members of other minority groups. As a result, the crime rate for such minority groups is higher than that for the white majority group. Nonwhites are also more likely to become the victims of crimes.

Most crimes in the United States are committed by boys and young men. Persons under 21 years of age

ARRESTS FOR MAJOR CRIMES BY AGE GROUPS
Total number of arrests in the United States in 1973—1,372,220



Source: *Uniform Crime Reports for the United States, 1973*, FBI.

account for about 70 per cent of the arrests for auto theft, burglary, and larceny. This same group makes up about 40 per cent of all persons arrested for aggravated assault, forcible rape, murder, and robbery.

There are several reasons why young people commit most crimes. As people become older and settled in their jobs and the rearing of children, they acquire a stake in society that they would not care to risk for momentary gain. On the other hand, young people have fewer job opportunities. The unskilled jobs available seem dull when compared to the quick and exciting returns from theft. Young people are also more willing to risk arrest and loss of reputation because they have less stake in things as they are.

About 85 per cent of the persons arrested for crimes are males, but the arrest rate for females has been increasing rapidly. From 1960 to the mid-1970's, arrests of females for serious crimes rose almost 300 per cent, and arrests of males increased about 90 per cent.

Many violent crimes are committed by persons who were acquainted with their victim. In about three-fourths of all murders, for example, the killer and his victim knew each other. In fact, about a fourth of all murders are committed by a member of the victim's family. In numerous cases, because so many murderers know their victims, the police have a relatively easy time identifying the killer. As a result, the arrest and conviction rate for murders is high. Police have a much harder time identifying robbers and burglars, few of whom know the victims.

Crime Prevention

For centuries, the criminal law has been built around the idea that a wrongdoer must be punished for his crime. The most basic argument for punishment is that it preserves law and order and respect for authority. From this point of view, punishment does two things. It upholds the law, and it prevents others from thinking they can get away with doing the same thing without punishment. Punishment is based on the idea that many persons have a barely controlled desire to act in forbidden ways. By punishing those who break the law, we reassure ourselves that we are right in controlling this desire. Thus, punishment is believed to maintain broad support for the law.

Many criminologists stress the need for improving the performance of criminal justice agencies—the police, the courts, and correctional institutions. For example, they point out that better educated, equipped, and coordinated police forces are more effective in controlling crime.

One of the best ways to reduce crime is to reform or rehabilitate habitual criminals. The fundamental problem is not the first offender or the petty thief but the repeated offender who commits increasingly serious crimes. According to criminologists, crime would decrease greatly if all such offenders could be turned away from wrongdoing. However, U.S. prisons have had little success in rehabilitating inmates. About two-thirds of the persons arrested in any year have a previous criminal record.

Rehabilitation of criminals could probably be improved greatly if experts could provide the right kind of program for different types of offenders. Criminals vary widely in the kinds of crimes they commit, their emotional problems, and their social and economic backgrounds. Not all offenders can be helped by the same course of treatment. Many require the aid of physicians, psychiatrists, or psychologists. Others respond well to educational or vocational training. There are about 400,000 criminals in U.S. correctional institutions, and about 800,000 more are on parole. Society spends about $1½ billion on them yearly, but only a small fraction of this sum goes to provide effective treatment. Nearly all the funds are used to feed and clothe prisoners and to keep them under control.

Although the reformation of hardened offenders would greatly reduce crime, it would be better to prevent people from becoming criminals in the first place. But no one really knows how this can be done. Chiefly, it would seem, crime prevention requires a program of thorough social reform in urban slums. Such a program would include improved housing, schools, and recreation; more job opportunities; and additional resources for helping families in trouble. Some forms of crime can be fought in other ways. For example, widespread publicity of convictions for tax evasion seems to produce a sharp drop in this crime for a period of time.

There are many other ways to reduce crime. People can be educated or persuaded to take greater precautions against crime. They can be taught, for example, how to protect their homes against burglary. Automobile thefts would drop sharply if drivers removed their keys and locked their cars when leaving them. Better lighting helps discourage purse-snatchings and other robberies on city streets and in parks. Many experts believe that strict gun-licensing laws would greatly reduce crime.

LLOYD E. OHLIN

Related Articles. See the WORLD BOOK article on CRIMINOLOGY. See also the following articles:

CRIMES

Abandonment	Blackmail	Contempt
Arson	Breach of the Peace	Counterfeiting
Assassination	Bribery	Desertion
Assault and Battery	Burglary	Embezzlement
Barratry	Collusion	Euthanasia
Bigamy	Conspiracy	Extortion
		Felony

CRIME SYNDICATE

Forgery	Libel	Riot
Fraud	Lynching	Robbery
Gambling	Manslaughter	Sabotage
Hijacking	Mayhem	Slander
Homicide	Misdemeanor	Smuggling
Juvenile Delinquency	Murder	Suicide
	Perjury	Treason
Kidnaping	Polygamy	Trespass
Larceny	Regicide	Vagrancy

Law Enforcement Procedures

Arrest	Footprinting	Lie Detector
Bail	Gun Control	Police
Bertillon System	Handcuffs	Search Warrant
False Imprisonment	Indictment	Warrant
Fingerprinting	Inquest	Wiretapping

Punishment

Amnesty	Forfeiture	Prison
Capital Punishment	Garrote	Rack
Chain Gang	Gas Chamber	Reprieve
Deportation	Guillotine	Sentence
Ducking Stool	Hanging	Stocks
Electrocution	Pardon	Torture
Exile	Parole	Whipping Post
Fine	Pillory	

Other Related Articles

Accessory	Bandit	Gang	Mafia
Accomplice	Camorra	Highwayman	Vendetta
Alienation	Feud		

CRIME SYNDICATE. See Crime.

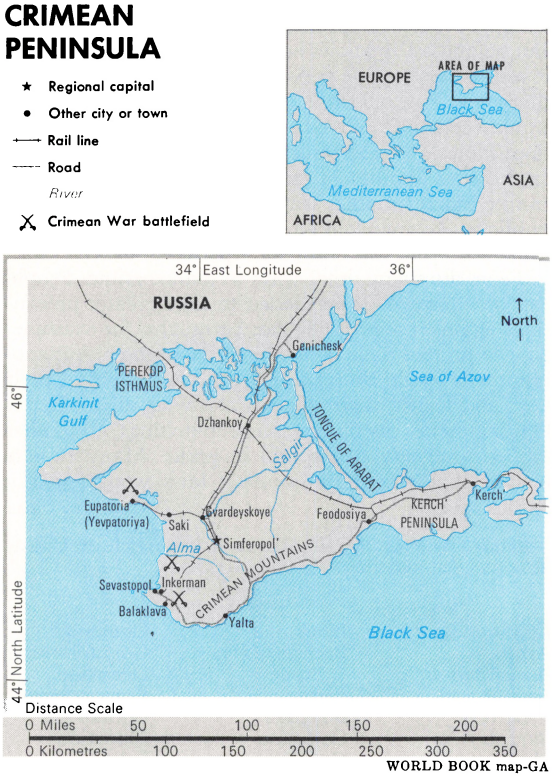
CRIMEA, *kry MEE uh,* is a peninsula which juts from the southern part of Russia into the Black Sea and the Sea of Azov. The Crimea covers an area of 10,425 square miles (27,000 square kilometers) and is joined to the mainland by the narrow Isthmus of Perekop. The population of the Crimea is about 1,851,000.

The Crimea rises gradually from coastal plains to the low Crimean Mountains along the southern coast. There are forests of cedar, magnolia, and olive trees, and many flowers grow in the meadows. The grassy plains furnish pasture for herds of sheep and horses. Grapes from the Crimea's vineyards go to make much of the wine of Russia. Grains flourish in the northern lowlands of the peninsula. Important deposits of iron, marble, and limestone have been found in the Crimea, and salt is dried along the coasts. The chief industries of the peninsula are shipbuilding, mining, and fishing. Resorts and health centers line the coasts.

The Crimea was one of the strongholds of opposition to the Soviet government after the Russian Revolution of 1917. Soviet troops put down the opposition in 1921, and the Crimea became an autonomous republic within the Russian Soviet Federated Socialist Republic. In World War II, German troops occupied the peninsula from 1941 to 1944. The Crimea's autonomous status was removed in 1945, and it became a province of the Russian Soviet Federated Socialist Republic. In 1954, the Crimea was transferred to the Ukrainian Soviet Socialist Republic. The capital of the Crimea is Simferopol'. Other cities include Kerch', Sevastopol, historically important Balaklava, and Yalta, which was the scene of the historic conference of allied leaders in World War II. Theodore Shabad

See also Crimean War; Sevastopol; Yalta.

CRIMEAN PENINSULA



WORLD BOOK map-GA

CRIMEA DECLARATION. See Roosevelt, Franklin D. (Yalta Conference).

CRIMEAN WAR (1853-1856) was fought between Russian forces and the allied armies of England, France, Turkey, and Sardinia. The immediate cause was a dispute among France, Russia, and Turkey about the control of the Holy Places in Jerusalem. The real causes of the war were political, commercial, strategic, and dynastic rivalries among the various nations. In the fighting, the allied armies drove the Russian forces out of Turkish territory and pursued them to the Crimean Peninsula. Chief battles took place at the River Alma, at Balaklava, at Inkerman, at Yevpatoriya, and at Sevastopol. The terms of peace were signed in Paris on March 30, 1856. Warren B. Walsh

See also Balaklava, Battle of; Nightingale, Florence; Paris, Treaties of (The Treaty of 1856).

CRIMINAL LAW. See Crime; Law.

CRIMINOLOGY, *krihm uh NAHL oh jih,* deals with the scientific study of crime and its treatment. It concerns the nature of crime, factors associated with criminal behavior, case studies of criminals, and the treatment of offenders. Most scientific research in criminology has been done in sociology, psychology, psychiatry, and related areas. In the United States, criminology is chiefly taught in college or university departments of sociology that consider the social and environmental causes of crime. But in European universities, criminology is generally taught in schools of law or medicine that give strong emphasis to the study of the relationship of biological factors to criminal behavior.

Early Criminology

The Classical School of criminology originated in a revolt against the harsh and arbitrary decisions of judges

during the 1700's. At that time, judges acted according to the circumstances surrounding a criminal case rather than the offense committed. Punishments varied considerably, and were often severe.

The rise of the Classical School is most closely associated with the Italian Criminologist Cesare Beccaria (1738-1794). Criminologists usually consider his book, *Crimes and Punishments* (1764), as the foundation stone of the Classical School.

Beccaria assumed that the criminal offender had free will, and that pleasure and pain governed his choices. He attempted to make punishment less arbitrary and less severe. He felt that everyone who violated a specific law should receive identical punishment regardless of age, sex, wealth, or position. But he thought that children and the insane should be excused from punishment because they did not have a well-developed free will.

Most of Beccaria's protests and recommendations were related to the administration of courts and of punishments. He urged that laws should be clear, providing a scale of crimes from the least serious to the most dangerous to society. In that way, each person would know just what punishment to expect if he committed a certain act. The purpose of punishment was to make sure that the guilty did not repeat the crime and that others were prevented from committing similar crimes. Beccaria felt that crime is prevented by the certainty and speed of punishment rather than by its severity.

Lawmakers in France worked out Beccaria's ideas in detail, and enacted them in the Code of 1791 and its later revisions. In English and American criminal law, the principles of the Classical School have been modified slightly, but retained.

The Positive School of criminology, also known as the *Italian School*, developed in the late 1800's. Its leaders included Cesare Lombroso, Enrico Ferri, and Raffaele Garofalo. The Classical School had been interested in the crime itself, but the Positive School turned the interest from crime to criminals.

Cesare Lombroso (1836-1909) believed that criminals had certain physical traits that made them different from other persons. He felt these traits resemble those man possessed at a lower stage of biological development. As a prison physician, he studied many criminals and reported that most of them had large jaws, receding foreheads, and other primitive physical traits. He called these characteristics *atavism*, and believed the *atavistic* criminal was a man "born" to be a criminal.

Criminologists found it easy to attack Lombroso's theory, because they observed that many criminals did not have these physical traits. Charles Goring in England in 1913 was among the first to deny Lombroso's theory of the born-criminal type. But even though Lombroso's ideas have now largely been proved false, he laid the basis for the science of modern criminology because he approached crime scientifically.

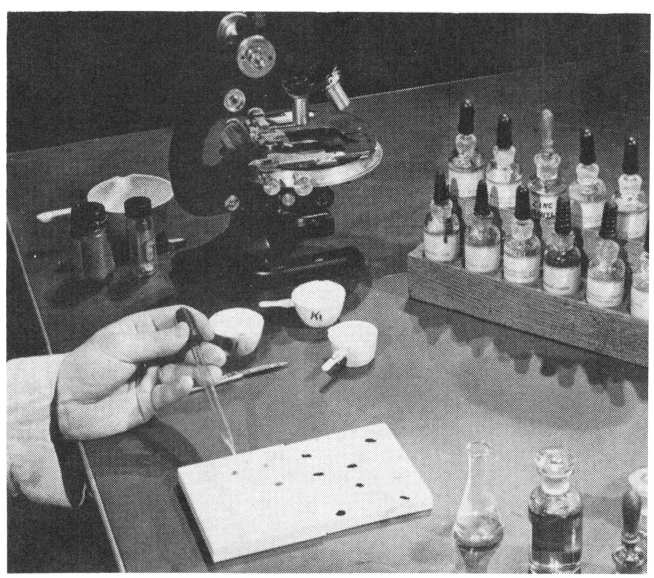
Enrico Ferri (1856-1929), another Italian, believed that society should try to prevent crime rather than to concentrate on punishment. He thought that scientific methods should be used in handling criminals. Ferri emphasized the effects of climate, customs, religion, and education in causing crime. He divided criminals into five classes: (1) born criminals, (2) criminally insane, (3) those who have formed the habit of crime, (4) those who commit crimes because of special circumstances (occasional criminals), and (5) those who are driven to crime by sudden, overwhelming emotion. In his book, *Criminal Sociology*, he described the way crime statistics change as social conditions vary as the "law of criminal saturation."

Raffaele Garofalo (1852-1934) agreed with Lombroso and Ferri that crime can be understood only by the use of scientific methods. He stressed the study of the criminal nature and the circumstances in which the criminal lives. Garofalo felt the criminal is a result of his biology and his own peculiar social environment—that he does not freely choose to commit crimes. He added his own definition of crime and classification of criminals to provide a new refinement to the Positive School.

In general, the Positive School shifted the emphasis of criminology from the study of the actual crime to the study of criminals and what might have caused their criminal acts.

Modern Criminology

Since the early 1900's, criminology has found leadership in the United States. Today, criminologists believe that crime results from many causes rather than one or two major factors. They do not consider the criminal as a special physical type. They do not believe that a person inherits criminal tendencies. Instead, they believe that crime results from the inability of the individual to deal with the world in which he lives, or from the failure of society to provide a proper environment. In the complex society of today, crime may result from the conflict between material goals and expected forms of behavior. These conflicts include association with criminals or persons with unfavorable attitudes toward the law; poverty, poor housing, and overcrowding; and other social conditions. Modern criminologists are interested in the connection between crime and such biological factors as inherited intelligence, glands, and



FBI

Criminologists Use Chemicals to determine whether poison is present in human organs.

bodily structure. But the greatest emphasis comes from sociologists who are concerned with environmental conditions that cause individuals to commit crime. Psychology and psychiatry have also thrown light on the motivation and emotions that play important roles in crime causation.

Detailed case studies of delinquents and statistical analyses of the many factors associated with delinquency indicate that offenders usually come from unwholesome backgrounds. For example, they frequently are the victims of broken homes, bad neighborhoods, emotional frustrations, lack of affection from parents, or poor supervision and discipline in the home. With such varied contributing causes, it is obvious that criminology does not assume that any single factor causes a man to commit a crime.

Techniques. Modern criminology uses sociologists, psychologists, psychiatrists, and other specialists working together to seek answers to questions about crime. Case studies and statistical tools are necessary in any important study of these causes. Usually, a group of delinquent boys and girls or of adult criminals is compared with a group of school children or adults in the community who are not delinquent but who are similar in all other important respects to the delinquent group. In this way, criminologists can measure significant differences between the two groups. These differences help to reveal many of the factors responsible for causing the delinquent or criminal group to commit crimes. Descriptions of delinquents or criminals are almost meaningless without a group of nondelinquents or noncriminals (usually called a *control group*) with which to make comparisons.

Rehabilitation. Modern criminology is also interested in the general field of *penology*, or the study of punishment. But it emphasizes treatment, rather than punishment, of the criminal. Prisons and parole systems exist to protect society and to reform the offender. Nearly all persons sent to prison are later released and returned to society. For this reason, the best way to protect society is to discover the major causes of criminal behavior. Then, criminologists and other specialists try to rehabilitate the offender so that on release he will be a well-adjusted citizen.

Capital Punishment. Most criminologists are opposed to the death penalty and to other forms of cruel and revengeful punishments. Modern criminologists favor applying scientific methods to the study of the causes of crime, and the handling of delinquents and criminals in courts, prisons, and upon their release from prisons.

Careers in Criminology

Most criminologists have university training in sociology, psychology, psychiatry, or related areas. Requirements vary for work in criminology, but most professional criminologists have master's or doctor's degrees. Technicians in the field, sometimes called *crimino-technicians* or *criminalists*, are involved in law enforcement, ballistics analysis, and other police investigative work. Other persons who work in the general area of criminology include social workers, such as parole and probation officers or correctional officers in prison; and policy-making administrators, such as prison superintendents, lawyers, and judges. MARVIN E. WOLFGANG

Related Articles in WORLD BOOK include:

Court	Juvenile Court	Prison
Crime	Parole	Sentence
Ethics		

CRINOID. See SEA LILY.

CRINOLINE, *KRIHN oh lin*, is a stiff fabric used for garment interlinings and in the binding of books. Crinoline is made from cotton, rayon, or synthetic fibers. It has a plain weave and a dull finish. It is stiffened with such substances as starch or glue. The original crinoline was made from horsehair and linen or cotton yarn. Women of the 1800's used crinoline petticoats to make their huge skirts billow out. KENNETH R. FOX

CRIOLLO. See CREOLE.

CRIPPLE. See HANDICAPPED (The Crippled).

CRIPPS, SIR STAFFORD (1889-1952), a noted English statesman and diplomat, held several important governmental posts. He served as ambassador to the Soviet Union from 1940 to 1942, and negotiated a wartime treaty of friendship. In 1942, he became lord privy seal and leader of the House of Commons, in which he represented East Bristol. Cripps became president of the board of trade in 1945. From 1947 to 1950, he held two important government posts, minister of economic affairs and chancellor of the exchequer. He retired from public life in 1950. Sir Stafford was born Richard Stafford Cripps in London. CHARLES LOCH MOWAT

CRISIS, THE. See PAINE, THOMAS.

CRISTALLO. See GLASS (The Middle Ages).

CRISTÓBAL, *kris TOH bul* (pop. 388), is a town in the Panama Canal Zone. It stands at the end of the Canal that opens into the Atlantic Ocean (see PANAMA [map]). Cristóbal has docks, a fueling station, and a shipyard. It serves as the port for the city of Colón.

CRISTOFORI, BARTOLOMMEO. See PIANO (History).

CRITIAS. See THIRTY TYRANTS.

CRITIC. See CRITICISM.

CRITICAL MASS. See ATOMIC BOMB (Critical Mass).

CRITICISM is the analysis and judgment of works of art. It tries to evaluate such works and examine the principles that influenced their creation. Criticism attempts to promote high standards of craftsmanship among artists and to encourage the appreciation of art. It also helps society remain aware of the value both of the art of the past and of recent developments in art.

Reviewing is closely related to criticism. A reviewer informs his audience about the merits and faults he sees in a particular work. His comments usually appear in a magazine or newspaper as soon as the work becomes available to the public.

Criticism plays an important part in every art form. This article discusses literary criticism.

Kinds of Literary Criticism. The basic type of criticism, called *intrinsic criticism*, examines the structure and style of a work. Intrinsic criticism also compares a work with other works of its *genre* (kind), such as other comic or tragic plays or other epic or lyric poems. It treats a work of art as complete in itself. On the other hand, *extrinsic criticism* deals with the relation of a work to the writer, the audience, and society. It may examine the writer's background to see how it might have influenced the work. Extrinsic criticism may also analyze the way in which the writer communicates his ideas.

Sometimes it involves the study of such fields as history, philosophy, and sociology, and takes the form of social criticism.

Other types of criticism include *impressionistic criticism*, *judicial criticism*, and *technical criticism*. In impressionistic criticism, a critic expresses his personal feelings about a work. Judicial criticism judges how well a work follows the accepted literary standards of certain periods of history. Technical criticism advises writers on how to improve their writing.

History of Literary Criticism. The most influential work of literary criticism was the *Poetics*, an essay by the ancient Greek philosopher Aristotle. The *Poetics* examines the nature of epic poetry and tragic drama and the psychological effects of art. Other early essays on criticism include *Art of Poetry*, by the Roman poet Horace, and *On the Sublime*, by the Greek writer Longinus. *Art of Poetry* is a handbook of rules for writing poems and plays. *On the Sublime* studies the psychological effects of art.

The history of criticism is closely related to the development of *classicism* and *romanticism*. One of the most important classical movements in Western Europe developed during the 1600's and 1700's. The classical writers based many of their theories on Aristotle's *Poetics*. They tried to portray the world objectively (see CLASSICISM). English critics who contributed to classicism included, in chronological order, Sir Philip Sidney, Ben Jonson, John Dryden, and Samuel Johnson.

During the last half of the 1700's, romanticism developed as a reaction against classicism. Romantic writers tried to portray their personal view of the world (see ROMANTICISM). Romanticism had an especially strong influence in England and Germany. English romantic critics included, in chronological order, Samuel Taylor Coleridge, William Wordsworth, and William Hazlitt. Among the important German romantic critics were Johann Wolfgang von Goethe, Friedrich von Schiller, August Wilhelm Schlegel, and Friedrich Schlegel.

In America, literary criticism has reflected both classicism and romanticism. From colonial times until about 1900, the classical view was more prominent than the romantic. But most of the writers who helped create a specifically American literature were romantics. These writers included William Cullen Bryant, Ralph Waldo Emerson, Edgar Allan Poe, and Walt Whitman.

During colonial times, writers in America imitated European literature. But in the 1800's, American writers began to write about their own American experience. Most American literary criticism dealt with democracy and nationalism. Leading critics who wrote about these issues included Emerson, Whitman, and William Dean Howells.

In the early 1900's, many critics believed critical attitudes should change to meet the problems of the new century. Such critics as Irving Babbitt and Paul Elmer More urged a return to classical values. These critics, called the *New Humanists*, opposed romanticism and encouraged writers to follow the standards of great classical literature of the past. Many critics strongly opposed the New Humanists, and this dispute lasted through the 1930's.

A movement called the *New Criticism* began during the last half of the 1930's. The New Critics encouraged critics to analyze literature intrinsically. This movement dominated American literary criticism through the mid-1960's. Leading New Critics included Cleanth Brooks, John Crowe Ransom, Allen Tate, and Robert Penn Warren.

SHERMAN PAUL

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Eliot, T. S.
Hazlitt, William
Howells, William Dean
James, Henry
Johnson, Samuel
Literature (Judging Literature)
Longinus
Poe, Edgar Allan
Ransom, John Crowe
Ruskin, John
Sainte-Beuve, Charles A.
Shakespeare, William (Shakespearean Criticism)
Taine, Hippolyte Adolphe
Tate, Allen
Wordsworth, William

CRITTENDEN COMPROMISE was a proposal submitted to the United States Senate in 1860 by Senator John Crittenden of Kentucky in an effort to keep the Southern States from leaving the Union. The Compromise proposed six amendments to the Constitution. Among other things it provided that slavery be protected south of 36° 30′, and prohibited north of that line. It also denied the right of Congress to abolish slavery "in places under its exclusive jurisdiction." It protected the interstate slave trade, and it provided for compensation by the United States to the owners of slaves who had been helped to escape. Defeat of the Compromise was due partly to President-elect Lincoln's opposition to any extension of slavery. JOHN DONALD HICKS

CRO-MAGNON MAN, *kroh MAG nahn*, was a type of prehistoric man who lived in Europe, Asia, and North Africa from about 35,000 to 8000 B.C. The name comes from the Cro-Magnon cave near Les Eyzies, in southwestern France. The first skeletons of Cro-Magnon man were found there in 1868, and more than 100 skeletons of Cro-Magnons have since been found. The skeletons indicate that these early people were strong and had a height of about 5 feet 8 inches (173 centimeters). The bone structure of Cro-Magnon man was the same as modern man's, and physically he resembled many of today's Europeans and North Africans. Most scientists believe that he was an early form of modern man.

Cro-Magnons hunted game on the grassy plains of Europe. These hunters made weapons with tools of bone and stone. They also used such tools to scrape skins and to sew hides for clothing and shelter. The tools varied from place to place, and the people improved them through the centuries. Most Cro-Magnons lived in shelters built in the open, but some made shelters in caves. Some family groups may have wandered long distances. They probably exchanged such items as special rocks for toolmaking with other groups.

Some Cro-Magnons produced beautiful cave paintings. Their interest in hunting led them to paint animal pictures in caves in southwestern France and northern Spain. They also made bone carvings and modeled in clay.

KARL W. BUTZER

See also PREHISTORIC MAN (Modern Man).

CROATIA, *kroh AY shuh*, is one of the six republics of Yugoslavia. Croatia covers 21,829 square miles (56,537 square kilometers) and has about 4,459,000

people, a fifth of Yugoslavia's total population. Most of Croatia's people belong to a Slavic group called Croats, who speak the Serbo-Croatian language and belong to the Roman Catholic Church. Zagreb is Croatia's capital and largest city.

Croatia consists of three land regions. The coastal region, called Dalmatia, lies between the Adriatic Sea and the republic of Bosnia and Hercegovina. The Dinaric Alps extend through the center of Croatia. The fertile Pannonian Plain borders Hungary. Croatia's two principal rivers, the Drava and the Sava, flow into the Danube, Yugoslavia's most important waterway.

Leading industries in Croatia produce chemicals, food products, petroleum, ships, and textiles. Zagreb is Croatia's chief manufacturing center. Tourism also contributes greatly to Croatia's economy. The most popular tourist resorts lie along the Adriatic coast. They include the islands of Brac, Hvar, and Krk and the historic walled city of Dubrovnik.

Slavic tribes began to settle in Croatia during the A.D. 600's. Croatia was independent in the 900's and 1000's, but Hungary ruled it after about 1100. In 1526, the Hapsburgs of Austria gained control of Hungary—including Croatia—and in 1867, Croatia became part of Austria-Hungary. Austria-Hungary was one of the losing nations in World War I (1914-1918). In 1918, Croatia united with Montenegro, Serbia, Slovenia, and several other nearby territories. They formed a new country called the Kingdom of Serbs, Croats, and Slovenes. In 1929, the name was changed to Yugoslavia.

Since the 1800's, many Croats have wanted to form an independent state. In 1945, the Communists came to power in Yugoslavia. They urged the Croats to develop greater loyalty to the national government. But in the 1960's, many Croats began to demand more self-government. They believed the nation's leaders took too much of Croatia's income and gave it to the other Yugoslav republics. Some Croats demanded complete independence. They thought Croatia should be separate because its people spoke a different dialect and followed a different religion than most people in the other republics. ALVIN Z. RUBINSTEIN

WORLD BOOK map

Location of Croatia

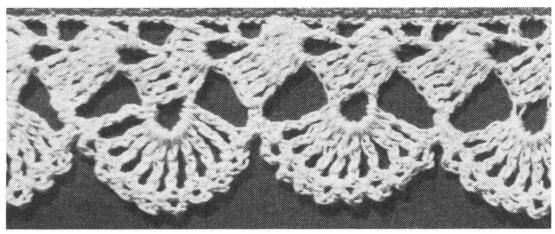
See also YUGOSLAVIA; ZAGREB.

CROATOAN. See LOST COLONY.

CROCE, BENEDETTO (1866-1952), was probably the most distinguished Italian philosopher of the 1900's. He believed that there are two kinds of knowledge: that which comes from understanding and that obtained from the imagination. Croce felt that imagination rules art. He believed that art does not attempt to classify objects as science does, but only feels and presents them. Croce also gained wide attention as the editor of *La Critica*, a journal of literature, philosophy, and history. His works include *Aesthetic* (1902), *Logic* (1905), and *Philosophy of the Practical* (1908).

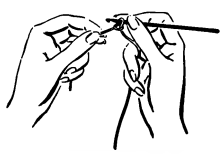
Croce was appointed a senator in 1910 and served as Italian minister of education from 1920 to 1921. After World War II, he helped form a new government. He was born in Pescasseroli, Italy. EUGENE ADAMS

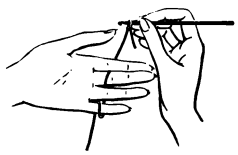
CROCHETING, *kroh SHAY ihng*, is a way of making lace by methods similar to those used in knitting. Crochet lace is heavy and inexpensive. Almost any


Educational Bureau, Coats and Clark, Inc.

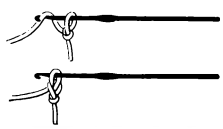
A Crocheted Edging, *above*, adds decoration to guest towels. Crochet lace is made with yarn or thread and a crochet hook. The illustrations below show how to make two basic stitches.

CHAIN STITCH


Make a loop or slipknot in thread and place it on hook.

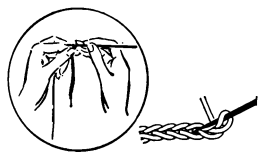

Arrange thread from ball around fingers of left hand.

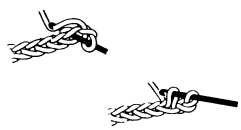
Hold the work with thumb and forefinger of the left hand.

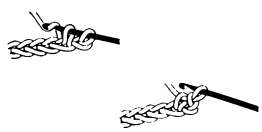

Catch thread and pull it back through loop for first stitch.

Continue making chain stitches. Practice makes even stitches.

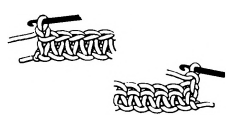
SINGLE CROCHET


Crochet a chain of 21 stitches. Insert hook in second loop back.


Catch the thread and draw it back through the chain.


Catch the thread again and draw it back through both.

Continue to make a single crochet in each chain stitch.


At end of row, make a chain, turn work, and start second row.

yarn or thread may be crocheted, but the most common is a hard-twist cotton thread. The lace is made by looping a single yarn or thread into fabric or a chain by means of a needle called a *crochet hook*. It is a narrow piece of metal, bone, wood, or plastic about 6 inches (15 centimeters) long that ends in a barblike hook. The French word *crochet* (meaning *crook* or *crooked*), applied to this hook, gave the lace its name.

A person can create many more variations of pattern with crochet stitches than with knitting needles. Variety in pattern is achieved by combining the three main stitches: chain, single crochet, and double crochet. The *chain* stitch is used to cast on and create pattern spaces. A loop of thread is placed upon the hook. The thread is wound over the needle, and drawn through this loop. *Single crochet* creates solid-pattern shapes and bars in an openwork pattern. *Double crochet* is used in the same way as single crochet, but is twice as wide. Other crochet stitches include *netting*, the *rose stitch*, and the *shell stitch*.

Crocheting is done with fine thread and a fine hook for lacy doilies and trimmings. A medium thread and needle are used for crocheting bedspreads, gloves, and potholders. With wool yarn and a needle of medium size, a person can crochet stoles, berets, sweaters, and afghans. Heavy yarns or fabric strips may be crocheted with a large hook to make rugs or mats.

Crocheting is an ancient craft. Although the lace can be made by machine, craftsmen in Belgium, Italy, France, and China continue to produce it by hand. An excellent type of Italian crochet work is called *Orvieto lace*.

The Irish have made perhaps the most beautiful crochet. Crochet lace was introduced into Ireland about 1820. Using very fine thread, Irish women developed a type of lace using a series of three-leafed shamrocks, roses, and little rings surrounded by a lacy background of chain stitches with small *picots*, or knots. This type of lace can be recognized by the whiteness of the linen thread used. Irish lace is used mainly for such things as collars, trimmings, and doilies. HELEN MARLEY CALAWAY

CROCKETT, DAVID (1786-1836), was one of the most famous frontiersmen in United States history. A hunter, scout, soldier, and Congressman, he also became a humorist who wrote and told tall tales about himself. An expert shot, he once reported he had killed 105 bears in nine months. A folk tale relates that once when he aimed his rifle at a raccoon in a tree, the animal recognized Crockett and said, "Don't shoot, Colonel. I'll come down. I know when I'm a gone coon."

Early Life. Crockett was born on Aug. 17, 1786, in Greene County, Tennessee. At 13, he ran away from home for three years. He then returned home and worked for a year to pay a $76 debt owed by his father, an innkeeper. When he was 18, Crockett married Polly Finley. When his first wife died, he married a young widow, Elizabeth Patton. The Crocketts moved four times, each time farther into the wilds of western Tennessee.

In 1813, Crockett volunteered as a scout for Andrew Jackson, who was ordered to subdue the warring Creek Indians. He later served in the Tennessee militia and won the rank of colonel.

Political Career. Crockett's first political office was as justice of the peace. His sincere manner and funny stories won him a seat in the Tennessee legislature from 1821 to 1823. In 1826, someone, as a joke, nominated him for the U.S. Congress. During the campaign tour, a flock of noisy guinea hens wandered into a meeting and drowned out Crockett's opponent's speech with their "cr-cr-kt" sounds. Crockett rose to say that those hens had been saying "Crockett!" He imitated their sounds to make them resemble his name. The story was repeated everywhere, and he won the election.

In Washington, D.C., Crockett and his stories caused a sensation. He served three terms between 1827 and 1835. He voted independently, and ardently disliked President Andrew Jackson's land and Indian policies.

Crockett's first book was *A Narrative of the Life of David Crockett*. Although several more books are credited to him, he wrote only two others, *An Account of Colonel Crockett's Tour to the North and Down East*, and *Colonel Crockett's Exploits and Adventures in Texas*.

The Alamo. After leaving Congress, Crockett joined about 186 men in the Alamo in San Antonio, where 5,000 Mexicans besieged them. The defenders fought to the last man, and Crockett died in the final assault on Mar. 6, 1836, his body riddled with bullets. Bold and brave, Crockett rates with Daniel Boone as a great frontiersman. HOWARD R. LAMAR

See also ALAMO; FOLKLORE (American Folklore); FINK, MIKE.

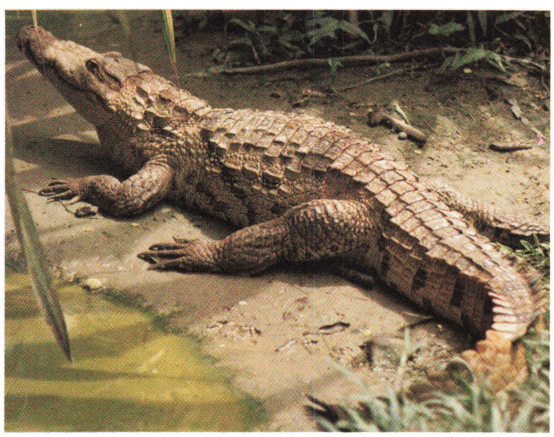
Oil painting by John Chapman; Humanities Research Center, University of Texas, Austin

"Davy" Crockett was a famous hunter, scout, soldier, and Congressman. He posed in hunting clothes for this portrait in 1834.

CROCODILE, *KRAHK uh dyl*, is one of the largest living reptiles. Crocodiles, alligators, gavials, and caymans look much alike, and are all called *crocodilians*. Both crocodiles and alligators have a long, low, cigar-shaped body, short legs, and long powerful tails with which they swim. They both have tough hides, long snouts, and sharp teeth to grasp their prey. In most crocodiles, however, the snout comes to a point in front, where an alligator's snout is rounded. The American crocodile is only about two-thirds as heavy as an old American alligator of the same length, and can move much more quickly. The lower fourth tooth is extra long in both animals. It fits into a pit in the alligator's upper jaw, but the crocodile's fourth tooth fits into a groove in the side of the upper jaw.

Caulion Singletary

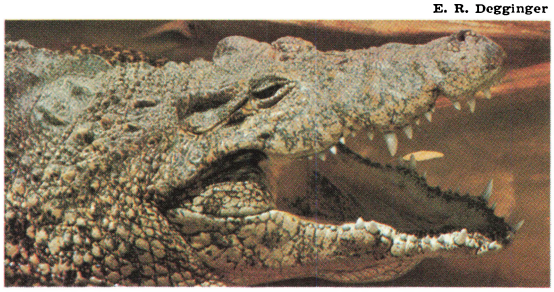
A Baby American Crocodile, *above,* hatches after about 105 days. At birth, it measures about 9 inches (23 centimeters) long.



Marc & Evelyne Bernheim, Woodfin Camp, Inc.

A Crocodile's Body is long and low. The animal uses its short legs, *above,* mainly for walking on land. Its sharp teeth are set in strong jaws, *below,* that can snap a heavy board in two.

E. R. Degginger



Crocodiles live in tropical countries throughout the world. They prefer large bodies of shallow water, sluggish rivers, open swamps, and marshes. Their webbed feet allow them to walk on the soft ground. Their eyes and nostrils are higher than the rest of the head. This arrangement fits in with the crocodile's life in the water, for it likes to float with only its eyes and nostrils above the surface. Its throat has a slit-like valve just in front of the tube leading to its nostrils. This valve shuts tight when the animal is under water. It keeps the water from entering through the mouth when the reptile seizes its prey.

Crocodiles eat many small animals, such as fishes, birds, and mammals, which they seize and swallow whole. Occasionally they attack large animals and men. A crocodile can twist a large animal into pieces by seizing it and then rapidly turning lengthwise in the water. Crocodiles are more aggressive than American or Chinese alligators. Large wild ones should be left alone.

Like most reptiles, crocodiles lay eggs. These look like hens' eggs, but are longer and have a less brittle shell. Crocodiles conceal their eggs in nests of rubbish and vegetation, or bury them in sand beaches. The female of some types guards the nest until the young are hatched. When she can hear them grunting, she digs them out. Not much is known about the breeding habits and general behavior of crocodiles.

Most of the true crocodiles inhabit the Eastern Hemisphere, but four species live in North and South America. The *American crocodile* lives in the extreme south of Florida, on the larger West Indian islands, and in Central America and areas near it. The usual length of adult American crocodiles is about 12 feet (3.7 meters). The *Nile crocodile* reigns supreme in Africa. It lives almost everywhere on the continent except in the Sahara and on the northern coast. This reptile was known by ancient peoples and described by the Greek historian, Herodotus. The small, long-snouted crocodile of the Congo Basin grows no longer than 8 feet (2.4 meters). The two kinds of dwarf crocodilians of Africa, one of which is very rare, are closely related to true crocodiles.

The giant *salt-water crocodile* lives in many places from India to northern Australia, and even in the Solomon Islands. The *mugger* lives in India and Pakistan, and the *Siamese crocodile* inhabits Java, Thailand, and nearby parts of Asia. There is also an *Australian crocodile*. Sumatra and the Malay Peninsula have the false *gavial*. The false gavial has a narrower snout than most other crocodilians.

The crocodilians are remnants of a large and ancient group of reptiles. Marks these reptiles have left on rocks show they once reached a length of 50 feet (15 meters). This is more than twice as long as any crocodiles living today. There are now 12 species of crocodiles.

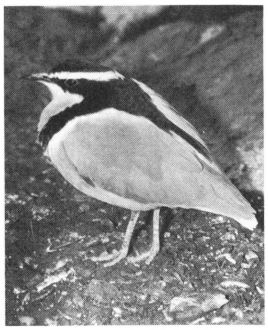
Crocodiles are important in commerce. The tough skin makes a high-grade leather that manufacturers frequently use in making such products as traveling bags, handbags, and shoes. Crocodile musk glands are used in the manufacture of perfume.

Scientific Classification. Crocodiles belong to the family *Crocodylidae*. The Nile crocodile is genus *Crocodylus*, species *C. niloticus*. The American crocodile is classified as *C. americanus*.

CLIFFORD H. POPE

See also ALLIGATOR; CROCODILE BIRD; GAVIAL; LIFE (table: Length of Life of Animals); REPTILE.

CROCODILE BIRD is an African bird that is a close relative of the plover. The crocodile bird flies down and feeds on insects that are living on the crocodile. The birds are common along the Nile River.



A. W. Ambler, NAS

The Crocodile Bird has earned the name "Zic-zac" because of its noisy cry.

Scientific Classification. The crocodile bird belongs to the family *Glareolidae*. The bird is classified as genus *Pluvianus*, species *P. aegyptius*. ALFRED M. BAILEY

CROCOITE. See LEAD (How Lead Is Obtained).

CROCUS, *KROH kuhs*, is a flowering herblike plant that grows in southern Europe and Asia, and is cultivated in many regions of the world. The crocus plant grows from a thick, bulblike stem called a *corm*. The leaves look like large leaves of grass. Crocus flowers grow at ground level. Each blossom is made up of six nearly equal segments, and has three stamens and a pistil. Some crocuses bloom early in spring, and others bloom in the autumn.

Gardeners plant crocuses about 3 inches (8 centimeters) deep in rich, well-drained soil. New corms form on top of old ones, so gardeners replant crocuses every few years. Probably the most popular crocuses are the purple and *cloth-of-gold*, a bright orange-yellow. The autumn crocus is *colchicum*. The *wild crocus*, also called pasqueflower, is an anemone, not a true crocus (see ANEMONE).

George Nelson, Artstreet

Crocuses

Crocus is the Latin word for *saffron*. Saffron was once used extensively to make a yellow dye and as a spice for food. Commercial saffron is obtained from the dried stigma of crocus plants cultivated chiefly in France, Italy, and Spain. The dye has largely been replaced by aniline dyes.

Scientific Classification. Spring crocuses belong to the iris family, *Iridaceae*. They make up the genus *Crocus*. The cloth-of-gold crocus is genus *Crocus*, species *C. susianus*. Autumn crocuses belong to the lily family, *Liliaceae*. They are genus *Colchicum*. ALFRED C. HOTTES

See also ANILINE; COLCHICUM; FLOWER (color picture: Spring Garden Flowers); SAFFRON.

CROESUS, *KREE suhs* (reigned 560-546 B.C.), was the last king of Lydia, a country in what is now western Turkey. Croesus raised Lydia to the peak of its power, conquering Greek coastal cities and extending his empire to the Halys River in central Asia Minor.

Croesus succeeded his father, Alyattes, as king. In 549 B.C., he formed an alliance with Babylonia, Egypt, and Sparta against Persia. Croesus attacked the Persians in 546 B.C., expecting help from his allies. But help could not reach him, and he withdrew to Sardis, his capital. Cyrus, the Persian leader, followed him there, and defeated him. Some historians believe Croesus was burned to death. Others say Cyrus made him governor of Media, a Persian province. JACOB J. FINKELSTEIN

See also ORACLES.

CROFTING. See BLEACHING.

CROIX DE GUERRE. See DECORATIONS AND MEDALS (France; color picture).

CROLY, HERBERT (1869-1930), was an American political philosopher. He favored the development of large corporations, large labor unions, and strong governments. He believed they would result in more goods, lower costs, and higher wages, and thus bring about an improved way of life for the American people. Croly's most important book was *The Promise of American Life* (1909). It warned against the carelessness and wastefulness of American economic planning in the past, and called for a national program of discipline under a strong central government. It also called for a tax on the incomes of corporations, a federal inheritance tax, and support of trade unions. Croly was born in New York City. He received an A.B. degree from Harvard University in 1910. In 1914, he founded the *New Republic* magazine. CHARLES FORCEY and LINDA FORCEY

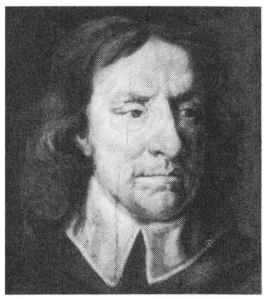
CROMPTON, SAMUEL (1753-1827), was an English weaver. By 1779, he had developed an improved spinning machine that led to major growth in the cotton industry. The new machine was called *the mule* because it was a cross between two machines, the spinning jenny and the water frame, while a mule is a cross between two animals. The mule made the strong, uniform cotton yarn required for fine muslin and calico.

Crompton did not get a patent on his machine, and he received little of the money that cloth manufacturers promised him. But Parliament gave him a national gift of $25,000 in 1812 when he was able to show that the more than $4\frac{1}{2}$ million mules in use had revolutionized the cotton industry. Crompton was born in Firwood, Lancashire. MONTE A. CALVERT

CROMWELL, OLIVER (1599-1658), led the forces of Parliament during the English Civil War. He ruled England during the period of the Commonwealth and Protectorate (1649-1658). Few men have inspired more love and reverence, and at the same time more fear and hatred. Cromwell was a man of iron will, true to a high moral purpose.

Cromwell was born in Huntingdon. His family had been favored by the English kings. Cromwell studied at Sidney Sussex College, Cambridge, and in 1620 he married Elizabeth Bourchier. He was elected to Parliament in 1628. In 1640, Cromwell was elected to what became known as the Short Parliament and to the Long Parliament that followed it (see LONG PARLIAMENT).

The Civil War. When the Civil War broke out in 1642, Cromwell became the leading force in Parliament. He had had no military experience until he was 40, but he was a born military genius. He trained his cavalry until he had the best-drilled regiments in England. He picked men for their religious enthusiasm as well as for their military forcefulness, and never lost a battle. In 1645, the Self-Denying Ordinance was passed, excluding members of Parliament from military command. But an exception was made in favor of



Crayon drawing by Samuel Cooper; Sidney Sussex College, Cambridge, England

Oliver Cromwell

Cromwell, who continued to lead his "Ironsides," as his forces were called.

When the break came between the two factions of the Puritans, the Presbyterians and the Independents, Cromwell sided with the Independents. He strengthened his hold on the army, while the Presbyterians dominated Parliament. Cromwell feared that the Presbyterians would restore the tyrannical king, Charles I, to power. Cromwell finally agreed to the execution of the king, and he was one of the signers of the death warrant.

The Protectorate. The Long Parliament had been in session for 12 years, but its members refused to disband or submit to Cromwell. He disbanded the Long Parliament in 1653 with the aid of his troops, and summoned a new one. But the new Parliament was not able to accomplish anything, and dissolved of its own accord. The officers of the army then took matters into their hands. They drew up the *Instrument of Government*, and made Cromwell Lord Protector. A Parliament was assembled, but the members seemed to have no purpose except to remain in Parliament. Cromwell dissolved it and relied on the army for support. The only other Parliament which he ever called, in 1656, offered him the title of king, which he refused. Although Cromwell was an opponent of absolutism, he governed almost as absolutely as had Charles I. The troubled conditions of the times forced him to adopt stern measures.

After Cromwell's death, his son, Richard (1626-1712), tried to continue his father's policy, but he lacked the strength. In May, 1659, he had to resign, and the people of England welcomed the return of King Charles II in 1660. W. M. SOUTHGATE

Related Articles in WORLD BOOK include:

Cavalier	Puritan
Charles (I; II) of England	Restoration
Furniture (English)	Roundhead

CROMWELL, RICHARD (1626-1712), ruled England as lord protector from September, 1658, to May, 1659. He succeeded his father, Oliver Cromwell, as lord protector. But he could not govern effectively, and a group of political and army leaders forced him to resign. In 1660, Parliament invited Charles Stuart to return from the Continent and rule as Charles II. Cromwell fled to France. He returned to England about 1680 and lived under a different name in Cheshunt for the rest of his life.

Cromwell was born in Huntingdon. He fought with Parliament's forces against King Charles I during the English Civil War (1642-1648). Cromwell was admitted to the Council of State and was named chancellor of Oxford University in 1657. VERNON F. SNOW

CROMWELL, THOMAS (1485?-1540), was a trusted adviser to King Henry VIII of England. A talented and ruthless administrator, Cromwell directed England's civil and religious affairs in the 1530's.

Cromwell is often called the architect of the English Reformation for his part in establishing Protestantism in England. Pope Clement VII had refused Henry's request for a divorce from Catherine of Aragon. Cromwell showed Henry that he could get the divorce by breaking with the Roman Catholic Church and by making himself head of an independent Church of England. Cromwell seized property belonging to monasteries for the king and demanded total obedience to the new religion. But later he fell from favor, and was beheaded.

Historians believe Cromwell was born in Putney, England. He became an assistant to Thomas Cardinal Wolsey in 1524. When Wolsey fell from power in 1529, Cromwell became principal secretary, vicar general, and lord privy seal. He was made Earl of Essex and lord chancellor in 1539. LACEY BALDWIN SMITH

CRONIN, A. J. (1896-), a British physician, became the author of several popular novels. He wrote *Hatter's Castle* (1931), his first novel, while recovering from an illness. This story of country life in Scotland brought Cronin literary fame. Cronin developed a pattern of centering his novels on a single problem or profession. *The Stars Look Down* (1935) describes poor working conditions in an English mining community. *The Citadel* (1937) is the story of a young Scottish doctor and also a critical study of the medical profession. *The Keys of the Kingdom* (1941) is a moving story about a Roman Catholic missionary priest in China.

Archibald Joseph Cronin was born in Cardross, Scotland. He studied at the University of Glasgow and practiced medicine from 1919 to 1930. He moved to the United States in the mid-1940's. JOHN ESPEY

CRONUS was the youngest child of Gaea, the earth; and Uranus, the sky, in Greek mythology. Unlike most gods, he did not represent a place, event, function, or quality. Cronus belonged to the race of gods known as Titans. The Roman god Saturn closely resembled him.

Uranus feared that his children would overthrow him, and so he confined them within Gaea's huge body. With Gaea's help, Cronus deposed Uranus and became king of the Titans. Cronus married his sister Rhea, and they had six children. Cronus feared that his children would depose him, too, and so he swallowed the first five of them at birth. Rhea hid the last child, Zeus, on the island of Crete. Then she tricked Cronus by giving him a large stone wrapped in baby clothes.

After Zeus grew to manhood, he helped his brothers and sisters escape. Together, they deposed Cronus, and Zeus became king of the gods. C. SCOTT LITTLETON

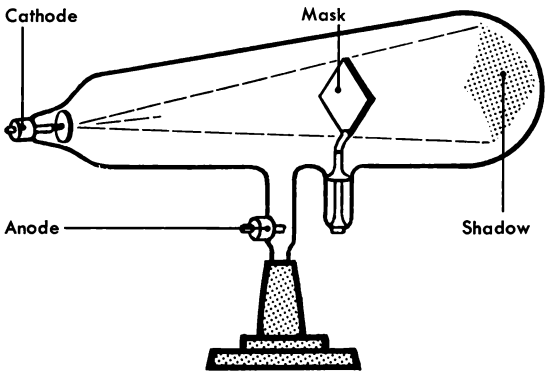
See also MYTHOLOGY (Greek Mythology); TITANS.

CROOKES, SIR WILLIAM (1832-1919), made many contributions to physics and chemistry. He invented the Crookes tube; the radiometer, which measures light energy; and the spinthariscope, a device for studying radioactivity. In 1886, he stated that some elements contain isotopes, or atoms which differ in weight. Crookes isolated the element thallium, and believed that all elements originally came from one fundamental substance. Crookes ranked as the foremost authority of his time on the industrial uses of chemistry.

Crookes was born in London and studied at the Royal College of Chemistry. R. T. ELLICKSON

See also RADIOMETER; SPINTHARISCOPE.

CROOKES TUBE, *krooks*, is a type of electronic vacuum tube. Sir William Crookes, an English physicist



A Crookes Tube produces cathode rays. These rays cause glass at the opposite end of the tube to *fluoresce* (give off light). A metal mask blocks some of the rays and casts a shadow.

and chemist, developed the tube in the 1870's as part of his study of what came to be called cathode rays. His work led to the discovery that these rays consist of streams of electrons.

A Crookes tube has electrodes at or near each end, and low air pressure inside. When a strong electric current flows from the *cathode* (negative electrode) to the *anode* (positive electrode), a glow appears in the end of the tube opposite the cathode. Crookes concluded that invisible rays from the cathode caused the glow. To study the rays, Crookes placed small objects in the rays' path within the tube. See CATHODE RAYS.

In 1879, Crookes suggested that the rays consisted of streams of negatively charged molecules. The English physicist Sir Joseph J. Thomson confirmed that the rays were charged particles of matter in 1897. Crookes tubes were forerunners of television picture tubes. Today, the Crookes tube is used only for classroom demonstrations. BERNARD S. FINN

CROP (of birds). See BIRD (Digestion).

CROP is a large number of plants of any given kind that are grown for man's use. Crops grown to feed man and the animals he raises for food are called *food crops*. Other crops produce fiber for use in clothing and other products. These are called *fiber crops*. Others are grown to *ornament* (decorate) man's surroundings.

Food crops include fruits, vegetables, *forage* (animal feed), and grains such as barley, corn, oats, rice, and wheat. Cotton, flax, and hemp provide fiber crops. Ornamental crops include flowers, lawn grasses, shrubs, and decorative trees. WILLIAM RAYMOND KAYS

For more detailed information, see AGRICULTURE (Growing Crops).

CROP DUSTER. See AIRPLANE (Special-Purpose).

CROP INSURANCE provides partial protection for a farmer's income in case of bad weather or loss of crops. It is usually a government program, because poor crop conditions over a wide area could ruin an insurance company. In the United States, the Federal Crop Insurance Corporation has insured such major crops as corn, cotton, tobacco, and wheat since 1938. The usual plan provides indemnities for insured farmers when their production falls below 50 or 75 per cent of average yield for the farm. The crop insurance program has been experimental, and has covered only a fraction of the total crop grown. Total premiums paid have ranged from $17 million to $51 million. H. G. HALCROW

See also FEDERAL CROP INSURANCE CORPORATION.

CROPPING SYSTEM is a method of growing crops and producing high yields without weakening the soil. It involves the combination of many cultivation methods to make the best possible use of the land. Farmers must consider the composition of their soil and the slope, drainage, and *erosion* (wearing away) problems of their land in determining the crops and production methods best suited for their land. Two important cultivation methods are the rotation of crops and the use of proper fertilizers.

One of the oldest and most widely used ways of preserving the soil is through the *rotation of crops* (alternating the crops grown in a field from one year to the next). A single crop will use up vital minerals and organic matter in the soil if it is grown in the same field year after year. But different kinds of crops planted in the field on a regular schedule will replace lost minerals and organic matter. For example, corn takes nitrogen out of the soil, while crops such as alfalfa and clover put nitrogen into the soil. If corn is planted in a field one year, alfalfa or clover may be planted in it the next year to replace the nitrogen used by the corn crop. The nitrogen producing crop can also be plowed into the soil. When it rots, it replaces lost organic matter and enriches the soil. On sloping land, grasses and deep-rooted crops are often alternated with other crops to hold the soil in place and prevent erosion.

The use of fertilizers is gradually replacing the crop rotation system as a means of producing the most profitable crops year after year while still keeping soil fertile. Nitrogen fertilizers and other fertilizers have been developed that can be used to return lost minerals and organic matter to the soil. When these fertilizers are added, and the proper cultivation methods are used, the same crop can be planted in a field year after year without harming the soil. If nitrogen fertilizer is added to the soil, corn can be planted in the same field for many years.

Other developments which save the soil include chemical insecticides and fungicides that kill harmful insects, weeds, and fungus growths. WILLIAM R. VAN DERSAL

CROQUET, *kroh KAY*, is a game that appeals to persons of almost all ages. It is popular with families, because it may easily be set up on lawns or in other play areas. Many municipal recreation departments have installed croquet courts, as have some parks and schools. Croquet is played outdoors on smooth grass for informal play, and on clay courts for tournaments. Play can be simple, or involve carefully planned strategy.

A Croquet Set consists of eight wooden balls painted in four colors; mallets with which to hit the balls; two stakes; and nine wide arches called *wickets*. The game requires an oblong, level, reasonably smooth area. Court dimensions may vary according to the space available, but should, if possible, be at least 30 by 60 feet (9 by 18 meters). The stakes should be centered at each end of the court, and the wickets placed in positions according to the accompanying diagram. In informal play, the placement of the wickets may be varied, adding to the challenge of the game.

CROQUET

The Game is usually played by four persons in two teams, each player with a mallet and one ball of matching color. Partners assist each other whenever possible. The game also may be played by two or three teams, or by two, three, or four individuals.

The object of the game is to hit the ball through all the wickets from stake to stake and back again. The ball passes through the first two wickets, then to the near right wicket, the center one, the far right one, and through the far double wickets to hit the stake. It returns to the home stake through the wickets on the other side in the same order. The player or team finishing the course first wins.

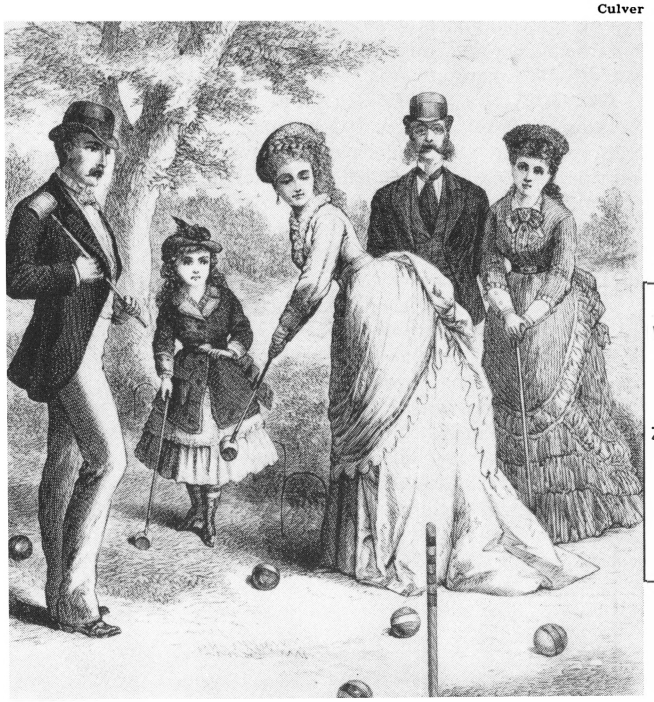
A player may hit the ball only once each turn. But he gets two strokes if his ball goes through a wicket, hits a stake, or hits an opponent's ball. If his ball hits that of an opponent, he may do one of several things. He may place his ball beside the other and hit it so that the other ball is sent out of position. This is done by putting his foot firmly on his own ball so that it will not move when he hits it. He then proceeds with his second shot. He also may hit both balls without using his foot, thus driving them both away. Other alternatives are placing his ball (1) two mallet lengths from the opponent's ball and taking one shot, or (2) one mallet's length and taking two shots. He may not hit the ball of an opponent again until he has passed through a wicket. A ball that has been hit once, or touched, is "dead." It may not be played again until the opponent has played.

Roque, which is the word croquet without the *c* and *t*, is the form of croquet used in league play in the United States. It uses 10 wickets, and the court is often surrounded by a low wall from which the balls may rebound. The standard size of the court is 50 by 100 feet (15 by 30 meters). Points are scored in roque, one for each wicket passed through and stake hit, with 16 points to win a game. A simplified version of croquet may be played inside on a table.

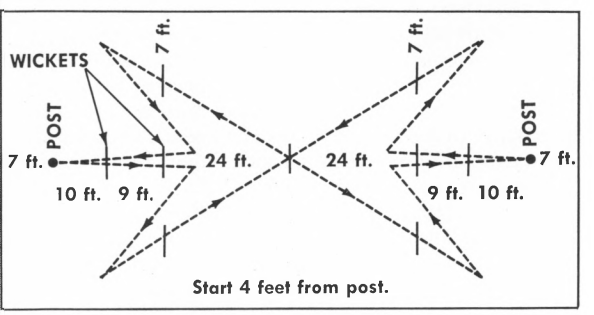
History. Croquet originated in France, where it was first known as *jeu de le maillet*. Later, it became known as *pall-mall* in England, and gave its name to a famous London street. It came to the United States with the early settlers.

DOROTHY DONALDSON

Culver



Croquet gained popularity in the 1800's. It won distinction as the first game played in the United States by both men and women, *left*. The informal croquet court, *below*, requires 9 wickets.



CRORE. See RUPEE.

CROSBY, BING (1904-), is one of the most popular singers and motion-picture stars in the United States. During the 1930's he made the "crooning" style of singing famous throughout the world. He won an award in 1944 from the Academy of Motion Picture Arts and Sciences for his performance as a singing priest in the film *Going My Way*.

Wide World

Bing Crosby

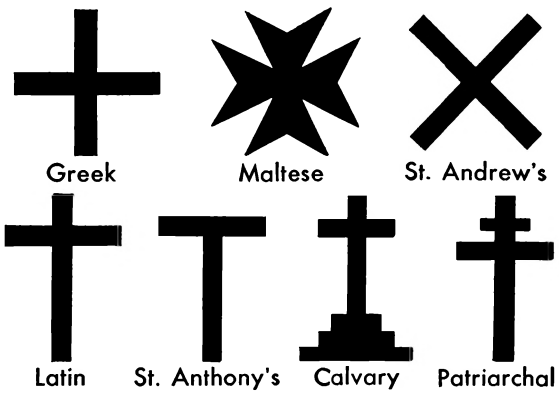
He was born HARRY LILLIS CROSBY in Tacoma, Wash., and studied law for a time. He started his career in 1924 with a Los Angeles dance band. By 1931, he was a member of the "Rhythm Boys," a singing trio with Paul Whiteman's orchestra. Radio performances and phonograph records increased Crosby's fame. He had four sons by his first wife, the late Dixie Lee. Crosby and his second wife, actress Kathryn Grant, have two sons and a daughter.

HARRIET VAN HORNE

CROSS is a sacred emblem of the Christian faith. It is a symbol of redemption, signifying Christ's death on the cross for man's sins.

Use Through the Ages. Slaves and criminals were punished on the cross, or crucified, long before the time of Jesus. They were tied or nailed to a standing cross until they died of thirst or hunger. Such a cross was made by fastening a piece of wood to a tree or pole. The arms of the condemned man were attached to this wood, or beam. Then he was lifted to an upright position. The prisoners often had to carry these beams to the places where they were to die. The New Testament says Jesus was forced to do this (John 19: 17).

The cross has had an enduring part in the profession of the Christian faith. The use of the cross as a symbol of faith goes back at least as far as the A.D. 100's. Tertullian, an early Christian writer, says that the Christians of his time used it daily. In his writings, St. Augustine speaks of the way in which the sign of the cross



Various Forms of Crosses Famous in History

was used in performing *sacraments* (the sacred acts of the Church).

Roman Catholics touch the fingers to the forehead, breast, left shoulder, and right shoulder. The Russian and Greek churches touch the right shoulder first.

Crosses were put up to mark the graves of heroes, kings, and bishops during the Middle Ages. Often, too, crosses were set up in market places. People preached beneath them. Today, churches often have a floor plan in the shape of a cross. Many forms of the cross have come down to us. The *Latin cross* is said to be the kind on which Jesus died. It is a long upright pole with a crosspiece near the top. FULTON J. SHEEN

Other Crosses. The *Greek cross* has four arms of the same length. Another name for it is the *Cross of Saint George*. This cross is used with the *Cross of Saint Andrew* and the *Cross of Saint Patrick* to form the British Union Flag. In this British flag, the Cross of Saint George stands for England, the Cross of Saint Andrew for Scotland, and the Cross of Saint Patrick for Ireland (see FLAG [color picture: Historical Flags of the World]). The *Maltese cross* with eight sharp points was used as an emblem by an order of knights of the Middle Ages.

See also CATHEDRAL; IRELAND (picture).

CROSS-COUNTRY is a type of long-distance racing in track and field sports. Runners usually race across fields, through woods, and over hills. Because distances and terrains differ for each race, no national or world records exist for this event. In the United States, the National Federation of High School Athletic Associations has set a minimum distance of $1\frac{1}{2}$ miles (2.4 kilometers) and a maximum distance of 3 miles (4.8 kilometers) for races. The National Collegiate Athletic Association and the Amateur Athletic Union have set a 3-mile minimum and a 7-mile (11-kilometer) maximum for cross-country events. See also TRACK and FIELD.

CROSS-EYE, or CROSSED EYE, is a general term describing eyes that do not look straight ahead. Doctors call this condition STRABISMUS or SQUINT. In most cases, one eye looks straight ahead while the other eye looks in toward the nose, upward, or out toward the side.

The most common form of cross-eye occurs in farsighted children under the age of 4. To see clearly, farsighted children often force their eyes together. This results in strabismus. This condition can be corrected in part or completely by eyeglasses.

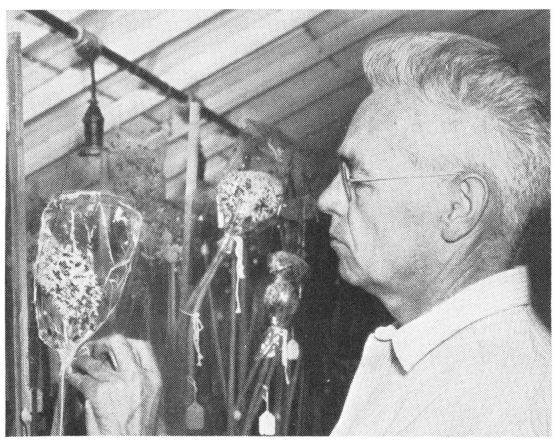
Cross-eye may also be inherited. It may result from eye muscles weakened by scar tissue or partly paralyzed muscular nerves. Cross-eye may also result from being able to use only one eye to see.

A child with one eye always crossed does not see double. But his vision will not develop properly unless this condition is corrected. Blindness may even result. A child with cross-eye should be treated by an eye physician. Surgery may be necessary to correct the eye muscles. WILLIAM F. HUGHES

CROSS-POLLINATION is a method by which many plants form seeds to grow new plants. Male pollen produced in anthers of stamens and female eggs produced in *ovaries* (seed cases) of pistils form seeds. Plants that make seeds in their own pistils with the pollen of other plants are *cross-pollinating* plants. Some willow trees, for example, have only male stamens, and others have only female pistils. Each new plant thus formed has two parent plants. A *self-pollinating* plant makes seeds from its own stamens and pistils.

Pollen may be carried from one plant to another by wind, water, insects, or birds. The plants are constructed so they can help the pollination. Many flowers, for example, contain nectar to attract birds and insects. The orchid carries its pollen in a sticky bundle which sticks to the insect when it reaches for the nectar. When the insect goes on to the next flower, the pollen is brushed onto the pistil when the insect pushes in for the nectar. The milkweed has its pollen in two little masses which are connected by a kind of strap. The bee gets its feet tangled in the strap and carries away the pollen, leaving it in the next flower. WILLIAM C. BEAVER

See also BREEDING; BURBANK, LUTHER; FLOWER (How Flowers Reproduce); HYBRID; POLLEN AND POLLINATION.



Purdy, U.S.D.A.

Self-Pollination of Onion Plants. Sometimes plant breeders wish to have flowers fertilized only by the pollen of the plants on which they grow. The flowers of the plants shown in this picture have been put into separate cellophane bags along with some flies. As they move from flower to flower, the flies deposit pollen on the pistils of the same plant.

CROSS REFERENCE is a method used in books, indexes, library catalogs, and filing systems to direct attention to additional information about a subject in another part of the book or index. Cross references are

widely used in encyclopedias, dictionaries, and textbooks. For instance, this article on CROSS REFERENCE mentions indexes. At the end of the article there is a cross reference reading "See also INDEX." The reader can find more information about indexes in that article. This type of cross reference is sometimes called a *related subject* or *article*. Cross references may also appear within the text of an article or chapter. THE WORLD BOOK ENCYCLOPEDIA article on the famous American author whose pen name was Mark Twain illustrates another kind of cross reference. Because he is best known as Mark Twain, his biography is given under TWAIN, MARK. But because his real name was Samuel Langhorne Clemens, there is an entry CLEMENS, SAMUEL LANGHORNE, which refers the reader to the article on Mark Twain in inverted form: Twain, Mark. This is a direct reference, and will be "See TWAIN, MARK," not "See also." Some books use the symbols *cf.* (from the Latin *confer*, meaning *compare*), or *q.v.* (from the Latin *quod vide*, meaning *which see*). R. B. DOWNS

See also INDEX.

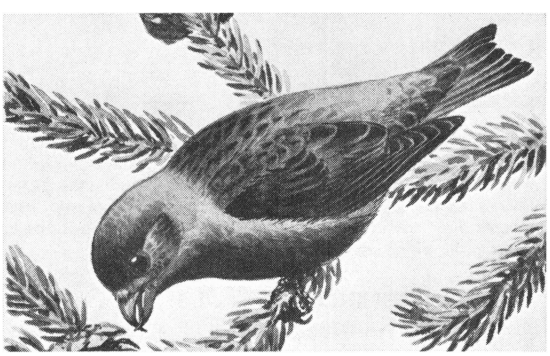
CROSSBILL is a gentle, friendly bird of the finch family. The ends of its bill cross each other.

The male red, or American, crossbill is colored brick red, with wings and tail of brown. It is about the size of an English sparrow. The plumage of the female is a slightly mottled, greenish yellow. This bird breeds from the northern states northward. In the region of the Allegheny Mountains, it breeds as far south as the Carolinas. In winter, crossbills wander in small flocks to the Gulf of Mexico, and west as far as Idaho and Arizona. They build their nests in the upper half of an evergreen, and the female lays 3 or 4 pale-greenish eggs with purple or lilac spots. Crossbills feed chiefly on seeds of cone-bearing trees. They also eat small quantities of buds and a few insects. The bird uses its crossed bill to lift the scales from the cones to get the seeds.

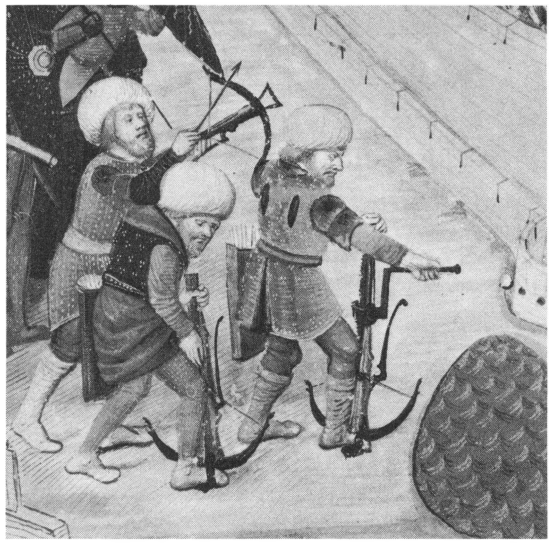
The white-winged crossbill is similar in habits to the red crossbill. It breeds from the northern states northward. During the winter, it wanders as far south as Virginia.

Scientific Classification. The crossbills belong to the finch family, *Fringillidae*. The red crossbill is genus *Loxia*, species *L. curvirostra*, variety *minor*. The white-winged crossbill is *L. leucoptera*. ARTHUR A. ALLEN

See also FINCH.



The Red Crossbill Feeds on Seeds from Cones.



Detail of an illuminated manuscript by an unknown artist; Bibliothèque Nationale, Paris

Turkish Forces Fought with Crossbows in 1480. Some archers used cranks to prepare their crossbows for shooting.

CROSSBOW was a popular weapon in the Middle Ages. It has a short, stiff bow set across the end of a stock. The bowman draws its string back and hooks it on a *nut* (catch). He places a short *quarrel* (arrow) against the string, aims, and shoots by pulling a trigger that releases the nut. The crossbow was so stiff that the bowman put his foot in a stirrup at one end and pulled the string taut with a hook or cord. It could be cocked and held ready, but was slower and had a much shorter range than the longbow. See also ARCHERY.

CROSSROADS OF AMERICA. See INDIANA; INDIANAPOLIS.

CROSSROADS OF THE PACIFIC. See HONOLULU.

CROSSROADS OF THE SOUTH. See JACKSON (Miss.).

CROSSROADS OF THE WORLD. See PANAMA.

CROSSWORD PUZZLE is a word game consisting of a diagram and a set of definitions or clues. The diagram usually has numbered vacant squares and black squares. The definitions are numbered to match the vacant squares, and provide clues to words that will fill the squares. When the correct words are written in, every letter used appears in both across and down words. The numbers start with *1. Across* and follow in order horizontally. One number appears in the first square of every series of vacant squares, both across and down. Definitions usually come from a dictionary. Some may be clues, anagrams, or riddles. Crosswords are the modern form of the ancient *word square*. The first crossword puzzle in an American newspaper appeared in the *New York Sunday World* on Dec. 21, 1913. JEAN ANDREW

CROTON, *KROH tuhn*, is a group of popular shrubs belonging to the spurge family. They grow in Florida and California, and in tropical climates throughout the world. The leaves have smooth edges and are often lobed. They may be spotted, streaked, or banded with yellow, white, green, and red. Because of these colors, the leaves are often used in wreaths. On some croton plants no two leaves have the same pattern. The flowers are small and hardly noticeable. The fruits are round

and split into two berrylike parts. Crotons grow best in good soil with a fair amount of moisture. Croton plants are used in lawns and parks, and in tubs on porches and patios.

Scientific Classification. The common croton belongs to the spurge family, *Euphorbiaceae*. It is genus *Codiaeum*, species *C. variegatum*, variety *pictum*. J. J. LEVISON

CROTON BUG. See COCKROACH.

CROUP, *kroop*, is an inflammation of the air passages that commonly occurs with respiratory infections. Children between the ages of 2 and 6 seem to be most susceptible. The condition is caused by anything that interferes with the passage of air to and from the lungs. For example, the small muscles that control breathing may not function properly. Sometimes pressure on the windpipe closes it so that air cannot pass through freely. In severe cases, a membrane may form over the airway, allowing no air to pass. This occurs most often in diphtheria (see DIPHTHERIA). Doctors call this condition *membranous croup*. Infections caused by streptococci and the influenza bacilli often result in croup.

Children with croup usually have symptoms common to all infectious diseases, such as a general feeling of discomfort, loss of appetite, and fever. Soon they develop the typical "croup cough," a hollow, barking sound that ends with a peculiar high-pitched whistle as they inhale. They breathe with a loud crowing or wheezing sound. As the condition progresses, they may turn blue because they cannot obtain enough air.

Doctors treat croup as they do other infectious diseases. They use drugs that destroy the germs which cause the condition. They often prescribe vaporizers to aid breathing. If membranous croup develops, it cuts off all passage of air. Then a surgeon often cuts an opening through the child's throat into the windpipe and inserts a metal tube. This life-saving operation allows the child to breathe again. ALBERT P. SELTZER

CROUPIER. See ROULETTE.

CROUSE, RUSSEL. See LINDSAY, HOWARD.

CROW is the name of a group of large black birds. The crow family includes crows, jays, ravens, magpies, rooks, jackdaws, and fish crows. Crows live in all parts of the world except New Zealand. The common crow

Karl Maslowski, Photo Researchers

The Common Crow is found in most parts of North America. It has a loud, shrill "caw, caw" cry that many people find irritating.

is a clever, fearless bird often seen in meadows, orchards, and wooded areas in much of North America. It usually winters in the United States or farther south.

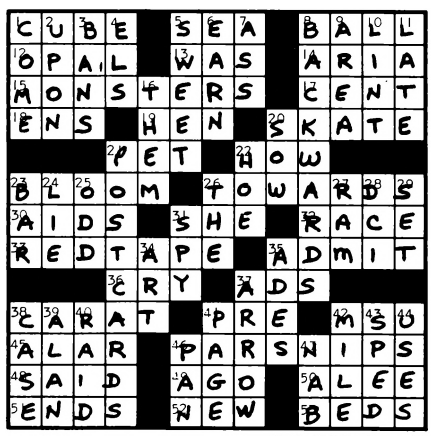
The common crow is about 18 to 19 inches (46 to 48 centimeters) long. It has glossy black plumage and a strong, sharp-pointed bill. Bristly feathers cover the base of the bill. The crow's feet are strong and well-adapted for walking. Male and female crows look about the same, but the female is slightly smaller. The crow does not have a musical voice, but it can make a variety of noises and can imitate sounds. Crows make good pets if obtained when young. Sometimes their owners can teach them to speak a few words like parrots do. Crows

ACROSS

1. Lump of sugar
5. Galilee, for example
8. Batter's target
12. October birthstone
13. Used to be
14. Diva's specialty
15. Bogeymen
17. Penny
18. Printer's measures
19. Barnyard clucker
20. Play ice hockey
21. Cat, dog, or canary
22. Indian's greeting
23. Blossom
26. In the direction of
30. Lends a hand
31. That girl
32. Indianapolis 500, for example
33. Troublesome bureaucratic complexity: 2 words
35. Confess
36. Shed tears
37. Sale announcements
38. Diamond size
41. Before: prefix.
42. Spartan campus at East Lansing: abbr.
45. Winglike
46. Vegetables
48. Declared
49. Long past
50. Away from the wind
51. Book holders
52. Original
53. Four-posters

DOWN

1. Arrive
2. Atop
3. Prohibits
4. Kays, ___, ems
5. ___ sixteen
6. Deserve
7. Donkey
8. In a reverse direction
9. Neighborhood
10. Bit of fluff
11. Behind time
16. Those people
20. Scatter seeds
21. Greetings from vacationers
22. Till the soil
23. Snack counter
24. Fib
25. Peculiar
26. Nothing but ___ best
27. Ewe's mate
28. 601: Roman numerals
29. Solidify
31. Foreign agent
34. Museum treasure
35. Summer beverages
37. Direction indicator
38. Attorney's concern
39. Chester ___ Arthur
40. Surprise attack
41. Book segment
42. Distance measure
43. Scurried
44. Puts into operation
46. Pot's relative
47. Arrest



Harle Publications, Inc., 1973

Crossword Puzzle Clues have numbers corresponding to numbered squares in a diagram. When the puzzle is completed, each letter in a square appears in both an *Across* and a *Down* word.

build their bulky nests along hedges or high in treetops. The female lays four to six eggs. The eggs are pale bluish-green, with irregular blotches and spots of brown and gray.

Farmers do not like crows because they pull up sprouting corn and eat it. They also eat young birds and eggs. But crows help farmers by eating insect pests. Scientists estimate that on an average farm, crows will eat 19 bushels (670 liters) of insects in a single season. The crow's diet varies with the time of year and the kinds of food available to him.

Scientific Classification. The crow belongs to the crow family, *Corvidae*. The common crow is genus *Corvus*, species *C. brachyrhynchos*. ALBERT WOLFSON

Related Articles in WORLD BOOK include:

Blue Jay	Jay	Raven
Jackdaw	Magpie	Rook

CROW, JIM. See JIM CROW.

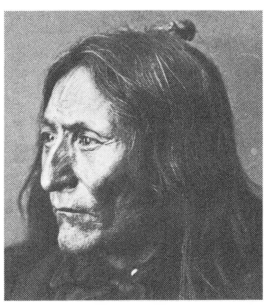
CROW INDIANS were the wealthiest tribe of the northern plains in the early 1800's. They owned many large herds of horses with elaborately decorated riding gear. Their tall, spacious tepees clustered in camps along the southern branches of the Yellowstone River in Montana and Wyoming. The name is a translation of the Crow Indian word *absaroke*, which means *crow*, *sparrow hawk*, or *bird people*.

Crow men were noted for their handsome profiles. Some leaders allowed their hair to grow far down their back. Crow women, known for their fine craftsmanship, made clothing of antelope and deer skin, and decorated it with dyed porcupine quills and glass beads. The sun dance and tobacco-planting ceremonies were especially sacred to these Indians.

The Crow were originally farmers, and lived on the Missouri River in what is now North Dakota. They moved westward before 1780 and became nomadic buffalo hunters. In 1805, Meriwether Lewis and William Clark, the American explorers, noted that the Crow were middlemen in lively trade between tribes on the Missouri and those west of the Rocky Mountains.

The Crow suffered heavy losses in their wars with the powerful Blackfoot and Sioux. They readily sought the friendship and protection of whites. A number of their young men served as scouts for the U.S. Army in the frontier wars with the Sioux and Cheyenne. The Crow reservation today lies in the tribe's traditional homeland of southeastern Montana. JOHN C. EWERS

CROWFOOT. See BUTTERCUP.



Glenbow-Alberta Institute

Crowfoot

CROWFOOT (1830-1890), a Canadian Blackfoot Indian chief, prevented his people from joining the 1885 Saskatchewan Rebellion against the Canadian government. The advance of white settlers into the Saskatchewan region disturbed many Indians. But Crowfoot realized that resistance would be foolish because the whites were so powerful. Government promises of food and other assistance to the Blackfoot helped influence Crowfoot to decide against joining the uprising.

Crowfoot was born in southern Alberta. His Indian name was Isapo-muxika. As a young man, Crowfoot became a noted warrior known for his bravery and scouting abilities. But he later urged his people to stop fighting the whites and other Indians. In 1866, Crowfoot became head chief of the Blackfoot. He settled on a reservation in 1877. HARTWELL BOWSFIELD

CROWN. See TEETH (picture: The Parts of a Tooth).

CROWN. See TREE (The Parts of a Tree).

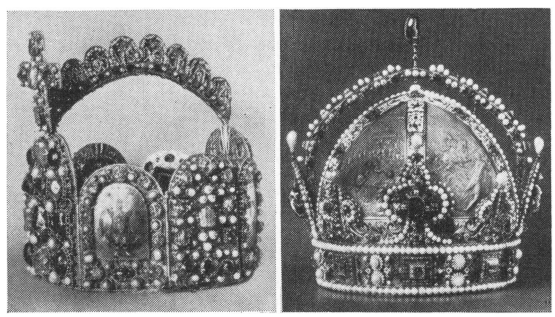
CROWN is a British coin worth 25 new pence, or one-fourth of a pound sterling. This is equal to about 60 cents in U.S. money. Once widely used, crowns are now coined only for special occasions. They are rarely seen in circulation. On one side, the crown bears a likeness of the king or queen who was reigning when the coin was minted. A coat of arms with symbolic designs is on the other. The crown was first issued in gold in the 1500's during the reign of Henry VIII. The crown, as it is known today, dates from 1551. Early crowns were made of fine silver, called crown silver. Since 1951, crowns have been struck in copper-nickel alloy instead of silver. BURTON H. HOBSON

Chase Manhattan Bank Money Museum

This British Crown was minted in 1707 during the reign of Queen Anne of England. Both sides of the old coin are shown.

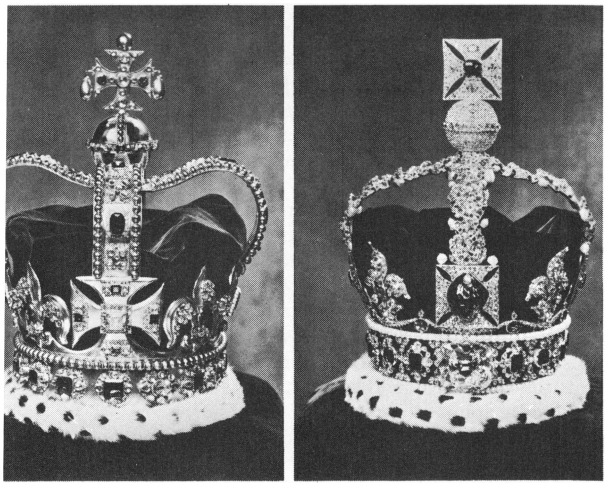
CROWN is a circular ornament worn on or around the head as a symbol of authority, merit, or distinction. A royal crown is a king's symbol of supreme authority, but is generally worn only on state occasions. Such crowns are usually made of gold, engraved, and ornamented with precious gems.

The British royal crown consists of a gold band studded with diamonds, pearls, and other precious



Art Institute of Chicago

Historic Crowns of Europe include the crown of the Holy Roman Empire, *left*, and the Imperial Crown of old Austria, *right*.



British Information Services

Historic British Crowns include St. Edward's Crown, *left*, copied from a crown worn by Edward the Confessor; and the British Imperial State Crown, worn by the monarch on state occasions.

stones. From the band rise crosses, fleurs-de-lis, and four arches, topped by a jeweled gold cross. The crown of the British ruler has much historic interest, and is considered to be priceless (see GEM [color picture]; ELIZABETH II [color picture]). A few crowns made for princes in India have famous, valuable jewels.

The Crown is a term often used to mean a monarch in his official capacity. The term can also mean a monarch's rule, position, or empire, of which the crown is a symbol.

The History of Crowns. Various jeweled headdresses were worn by rulers of ancient Egypt and Assyria. The Greeks gave a crown or diadem of olive leaves to their athletes as a symbol of victory. Later the Romans adopted this custom. Their crowns were made of metal, usually gold, and were worn by the Roman emperors. From the reign of Constantine (306-337), the diadem was regarded as the symbol of royal power. Later European rulers probably borrowed the practice of wearing a crown from the Romans.

Iron Crown of Lombardy was a crown worn by the Lombard kings and the emperors of the Holy Roman Empire when they became kings of Lombardy. It is made of gold, decorated with jewels and cloisonné enamel. Its name comes from an inner iron circlet which tradition says was beaten from a nail of the cross of Christ. Lombard workmen probably made it in the A.D. 500's. Charlemagne, Charles V, and Napoleon I wore the Iron Crown. It is preserved in the Cathedral of Saint John the Baptist at Monza, Italy. WILLIAM M. MILLIKEN

CROWN COLONY is a British overseas possession acquired by conquest or cession. It differs from a *protectorate*, where the British exercise control by virtue of treaties with local rulers (see PROTECTORATE). Great Britain's Commonwealth Office rules crown colonies, and a governor and members of the Overseas Service govern them. In some places, especially those of strategic importance, such as Gibraltar, the governor legislates alone. In others, an executive council and a legislative assembly assist the governor in the administration and legislation of the colony. Members of some of the legislative assemblies may be elected, while members of others may be appointed. ROBERT G. NEUMANN

CROWN POINT is a high spur of land on the southwestern shore of Lake Champlain in New York. It became an early frontier post and fortress. The location was important because Lake Champlain was a water highway between Canada and the northern English colonies. The lake is so narrow at Crown Point that a few cannon could command the passage and shut off an enemy's fleet. The French built Fort St. Frederic at Crown Point in 1731 and destroyed it in 1759 to prevent its capture by an advancing English army. The English built a new and larger fort near the place where Fort St. Frederic had stood. The English fort was intended to protect nearby Fort Ticonderoga from attack by water. At the start of the Revolutionary War, a group of "Green Mountain Boys" under Seth Warner took Crown Point while Colonel Benedict Arnold and Ethan Allen captured Ticonderoga. The ruins of the early French fort and of the English fort are preserved in a New York state park. Crown Point is now the name of a township and a village in Essex County, N.Y. See also GREEN MOUNTAIN BOYS. JOHN R. ALDEN

CRUCIBLE. See IRON AND STEEL (Methods of Making Steel).

CRUCIFIXION. See JESUS CHRIST (The Crucifixion); ANDREW, SAINT; SPARTACUS.

CRUDE OIL. See PETROLEUM (introduction).

CRUIKSHANK, *CROOK shank*, **GEORGE** (1792-1878), an English artist, became famous for his caricatures and illustrations. His more than 5,000 works range from caricatures to historical paintings.

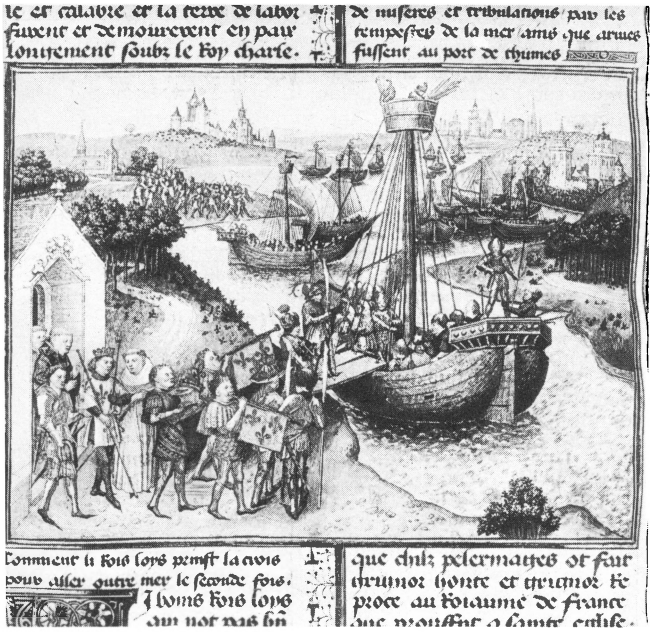
As a caricaturist, he commented on his times for more than 50 years. As an illustrator, he worked closely with Charles Dickens to produce a famous series of etchings for *Oliver Twist*. He also illustrated books by such writers as Oliver Goldsmith, Henry Fielding, and Miguel de Cervantes. He joined a movement to suppress alcoholism, and produced a series of drawings on the evils of drunkenness. Cruikshank was born in London, the son of a political caricaturist. NORMAN L. RICE

CRUISER is a smaller warship than a battleship, but faster and with a longer cruising range. It carries no heavy armor, but is armed with hard-hitting attack weapons. A cruiser is used for specialized attack missions, scouting, and screening. Cruisers are also important in task force organization.

Cruisers were once classified as light, heavy, and battle cruisers. *Light* and *heavy* cruisers differed primarily in the size of the guns in their main batteries. A light cruiser mounted 6-inch (15-centimeter) guns, while heavy cruisers carried 8-inch (20-centimeter) guns. *Battle* cruisers were actually fast battleships with light armor.

Like the battleship, the conventional cruiser is becoming obsolete. But the United States Navy has converted several cruisers into guided-missile cruisers. The most modern cruiser is the nuclear-powered guided-missile cruiser U.S.S. *Long Beach*. This ship displaces 17,350 long tons (17,628 metric tons) when fully loaded. RAYMOND V. B. BLACKMAN

See also BATTLESHIP; NAVY, UNITED STATES (picture: Warships of the Navy); WARSHIP.



Giraudon

Saint Louis Departs from Southern France for North Africa in this illustration from a medieval chronicle in the Hermitage in Leningrad, Russia. The king and his army planned to capture the territory from the Moslems, but he died of plague when he reached Africa. His death ended the Eighth Crusade.

A Crusader's Fortress, the Krak des Chevaliers, was powerfully built to withstand Moslem attacks. This castle, which stands in Syria, was built by the Knights of Saint John (Knights Hospitallers) in the 1100's. Such fortresses could house several thousand fighting men and their servants.

Aerofilms, Ltd.

CRUSADES were Christian military expeditions to recapture the Holy Land, where Jesus had lived. *Moslems* (members of the Islamic faith) held the Holy Land. The crusades began shortly before A.D. 1100 and lasted until almost 1300. The men who fought in them came from western Europe.

Christians were aroused to organize the crusades primarily by religious faith. But the expeditions also were part of the larger effort by Europeans to increase their power, territory, and riches. Even before the crusades, the Christians had begun to reconquer lands in Europe that had been seized by the Moslems. By the time of the First Crusade, the Christians had already retaken southern Italy and Sicily and had put the Moslems on the defensive in Spain.

The word *crusade* comes from the Latin word *crux*, meaning *cross*. Members of the expeditions sewed the symbol of the cross of Christ on *tunics* (outer clothing). "To take the cross" meant to become a crusader.

How the Crusades Began. Arabs, who were of the Islamic faith, conquered the area around the eastern shore of the Mediterranean Sea in the A.D. 600's. Jerusalem and other places where Jesus had lived remained under Arab rule until the 1000's. To Christians, these places were sacred. Most of the Arab rulers allowed the Christians to visit the sacred places. But during the 1000's, the fierce Seljuk Turks swept in from Turkestan in Asia, took all of Asia Minor (now Turkey) from the Byzantine Empire, and occupied Arab Syria, which included the Holy Land. The Turks captured Jerusalem in 1071. Then they began to interfere with Christian pilgrims who tried to visit the holy places.

In the early 1090's, the Byzantine emperor, Alexius Comnenus, asked Pope Urban II for help in fighting the Turks. Urban viewed the appeal as an opportunity to win glory for the church. He also believed that a military expedition against a common foe would help reduce warfare among European kings and nobles. In the autumn of 1095, Urban called a great assembly of churchmen and nobles at Clermont, France. At the meeting, which became known as the *Council of Clermont*, Urban gave a stirring sermon. He urged the knights of Europe to stop their feuds and rescue the Holy Land from the Turks. The assembly was aroused, and shouts of "God wills it!" filled the air. Preachers such as Peter the Hermit swiftly spread the enthusiasm throughout Europe. Thousands enrolled in the cause.

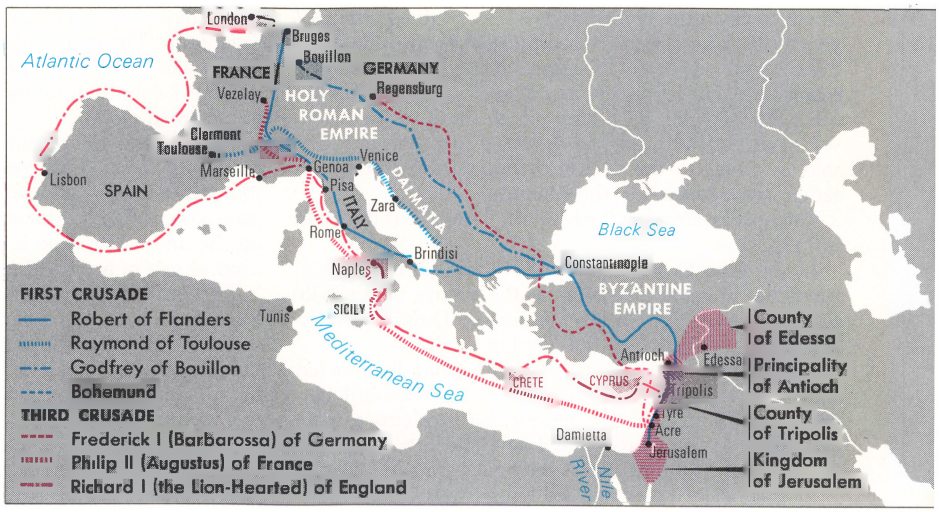
But not all the crusaders took the cross for religious reasons. Some, such as the Normans, hoped to win glory, wealth, and new lands. Merchants, such as those in the Italian cities of Genoa and Venice, joined in search of new markets.

The First Crusade (1096-1099). Led by Peter the Hermit, bands of common people started out for the Holy Land before the main armies of knights. These people were poorly trained and poorly equipped for fighting. They marched toward Constantinople (now Istanbul), the capital of the Byzantine Empire. Few reached their goal. Some starved. Eastern Europeans killed others. The

Bryce Lyon, the contributor of this article, is Barnaby C. and Mary Critchfield Keeney Professor of History at Brown University and author of Mediaeval History.

First and Third Crusades

This map shows where the First and Third Crusades started and the routes the crusaders followed to the Holy Land. The First Crusade began in 1096 and ended in 1099. The crusaders succeeded in capturing Jerusalem. They also established the Latin States of the Crusaders: *Edessa, Antioch, Tripolis,* and *Jerusalem*. The Third Crusade began in 1189 and ended in 1192. The crusaders failed to recapture Jerusalem, but won an agreement with the Turks to permit Christians to visit the city.



0 200 400 Miles
0 200 400 600 Kilometers

WORLD BOOK map FGA

Turks slaughtered most of those who crossed into Asia Minor.

The expedition went far better for the knights, who were trained warriors. Most of the knights came from France. Their chief leaders included Count Robert of Flanders, Count Raymond of Toulouse, Godfrey of Bouillon, and Bohemund, a Norman lord from Sicily.

Separate armies of knights left Europe in the autumn of 1096. Some marched overland to Constantinople. Others went there by ship. The crusaders joined and invaded Asia Minor in early 1097. They then began their long march to Jerusalem. On the way, they fought many bloody battles. Antioch, in Syria (now in Turkey), was the most important city on their route, and it was the most difficult to capture. Fleets from Italy brought in supplies and more fighters as the crusaders marched south. As the expedition continued, the leaders of the crusade quarreled among themselves. The crusaders finally arrived at Jerusalem in the summer of 1099, and captured the city after six weeks of fighting.

Most of the crusaders then returned home. Those who remained founded a group of four states on the eastern shore of the Mediterranean Sea. These states were called the *Latin States of the Crusaders*. From the north to the south, they were named: the County of Edessa, the Principality of Antioch, the County of Tripolis, and the Kingdom of Jerusalem.

The Second Crusade (1147-1149). Too few crusaders remained to defend the Holy Land. Less than 50 years after the victories of the First Crusade, the Turks conquered the County of Edessa.

The Turkish triumph brought about the Second Crusade. This time the preachings of Saint Bernard stirred Europe. King Louis VII of France and Emperor Conrad III of Germany led armies into Asia Minor, but they did not cooperate with each other. The Turks defeated them before they reached Edessa. This failure encouraged other Moslems to renew their attacks on Christian strongholds.

The Third Crusade (1189-1192) followed the recapture of the city of Jerusalem by the Moslems in 1187. The Moslems reconquered much of the Holy Land under their leader, Saladin. Only Tyre, Tripolis, and Antioch remained in Christian hands.

The most important rulers of Europe launched the Third Crusade. One of them, the German Emperor Frederick I (called Barbarossa), died before arriving in the Holy Land. Quarrels among the other rulers kept the crusaders from complete success. King Philip II (called Philip Augustus) of France returned home soon after arriving in the Holy Land. He pretended to be ill. But his real reason for returning was to plot against King Richard I (the Lion-Hearted) of England, who remained to fight in the Holy Land. Richard was a great warrior. He defeated Saladin in several battles and recaptured Acre (now Akko), which is north of Jerusalem. He could not retake Jerusalem, but he persuaded the Moslems to let Christian pilgrims enter the city freely.

The Fourth Crusade (1201-1204) was the last serious expedition against the Moslems. Pope Innocent III persuaded many French nobles to take part in this expedition. The crusaders bargained with the Venetians to take them by ship to the eastern Mediterranean. But when they got to Venice, they could not pay the costs. The Venetians said they would transport the crusaders to the Holy Land if the crusaders helped them attack the Byzantine Empire. The combined forces of the Venetians and crusaders first captured the town of Zara, in Dalmatia. Then they seized Constantinople after a fierce battle. The victors removed the Byzantine Emperor from his throne and replaced him with Count Baldwin of Flanders. The Venetians and crusaders divided Byzantine territory and riches among themselves. They ruled the Byzantine Empire until 1261.

The Fourth Crusade was not a crusade against the Moslems at all. It was an expedition for economic and political gain. The real victors were the Venetians, who expanded their trading area into Byzantine lands. The crusaders never reached the Holy Land, and much of it remained in the hands of the Moslems.

The Children's Crusade (1212) was not important to history. But for hundreds of years, it has interested people as a tragic story.

The crusaders were boys and girls stirred by religious

fervor to go to the Holy Land. Many were less than 12 years old. There were two armies of them, one from France and one from Germany. None of the children reached the Holy Land. Many died of hunger, cold, and other hardships on their long march south to the Mediterranean Sea. Others were drowned in storms at sea or sold as slaves to the Moslems. Few of the young crusaders ever returned to their homes.

Other Crusades continued in the 1200's, but they had little success.

In the Fifth Crusade (1217-1221), the Christians captured the town of Damietta at the mouth of the Nile River in Egypt. But they soon gave up Damietta in exchange for a truce with the Moslems.

Emperor Frederick II of the Holy Roman Empire led the Sixth Crusade (1228-1229). He was a skillful bargainer. Without a battle, he got the Moslems to give Jerusalem to the Christians. The Holy City remained Christian until the Moslems seized it again in 1244.

The fall of Jerusalem caused King Louis IX of France (Saint Louis) to lead the Seventh Crusade (1248-1254). Louis took Damietta without a fight. But the Turks then surrounded and captured the crusaders. They freed Louis and his noblemen only after the Christians paid a huge ransom. Seeking revenge, Louis led the Eighth Crusade (1270) against the Moslems of northern Africa. He landed his army at Tunis. But, old and ill, he died at Carthage. His army returned to Europe.

In the East, meanwhile, the Moslems continued to make gains against the Christians. They captured Antioch in 1268. In 1291, they seized Acre (now 'Akko), the last Christian foothold in Syria.

By this time, Europeans were losing interest in the Holy Land. There were weak attempts to organize crusades in the 1300's and 1400's, but none of them succeeded. Europe was turning its attention westward to the Atlantic Ocean and beyond. In 1492, the Spaniards drove the Moslem Moors out of Europe. In the same year, Columbus sailed to the New World. Europe turned toward America to satisfy its ambition to expand. The Holy Land belonged to the Moslems.

Results of the Crusades. The expeditions to the Holy Land prepared Europe for expansion into America. They acquainted westerners with the way of life of the East. Europeans acquired new tastes in food and clothing. Their desire to travel increased. During the crusades, they learned how to make better ships and better maps. And they learned new ways to make war. The crusades quickened the progress of western Europe by bringing profit and prosperity to Italian trading cities. They enriched European life in many ways. BRYCE LYON

Related Articles in WORLD BOOK include:

Byzantine Empire	Knights Templars
Feudalism	Louis (IX) of France
Flag (color pictures: Historical Flags of the World)	Moslems
	Palestine
Frederick (I and II) Holy Roman Emperors	Peter the Hermit
	Philip (II) of France
Godfrey of Bouillon	Richard (I) of England
Innocent (III)	Saladin
Knights and Knighthood	Seljuk
Knights of Saint John	Urban (II)

For a *Reading and Study Guide on the Crusades*, see the RESEARCH GUIDE/INDEX, Volume 22.

CRUSOE, ROBINSON. See ROBINSON CRUSOE.

CRUSTACEAN, *crus TAY shun*, is an animal without a backbone. An armorlike shell covers its body. Crustaceans make up a class of joint-footed animals called *arthropods*. There are about 30,000 *species* (kinds) of crustaceans. They include crayfish, crabs, lobsters, and shrimp. Like other animals with shells, crustaceans are often called *shellfish*.

Their Bodies. All crustaceans are covered with a hard coating of *chitin*. This covering is sometimes like bone, sometimes tough and leathery, and sometimes thin and transparent. The hardness of the body covering depends on the amount of lime in the chitin. The covering is a kind of suit of armor which protects the animal.

The body of the crustacean is divided into sections. Each section usually bears a pair of jointed legs. The sections of the body and head are closely jointed. Legs under and in front of the face are used to hold, tear, and taste food. Other legs on the head are used as jaws, toothbrushes, and feelers. Special legs under the body are used for walking. Large legs, or pincers, on the body are used for catching fish, cracking young oysters, digging burrows, and fighting. Slow swimming legs under the tail are sometimes used to hold the eggs. The legs at the end of the tail are flattened to form a fan-shaped fin which is used in swimming backward.

Crustaceans have one, two, or more compound or single eyes. The eyes of larger kinds are usually on stalks that turn and move the eyes. The lobster has two compound eyes that are really clusters of many simple eyes.

Life Story. Crustaceans reproduce by means of eggs which are usually hatched in water. Some crustaceans, such as lobsters, carry their eggs and young on the hairs of the swimming legs. The eggs of different crustaceans hatch at various stages of development. Young lobsters and crayfish look like their parents, while young crabs do not. After the eggs hatch, the young crustaceans grow until their shells become too tight. Then the growing crustacean exchanges its old shell for a larger new one. The process of changing shells is called *molting*, and takes place several times during growth. The new shell forms inside the old one, and is soft and wrinkled like a suit packed in a small box. When the lobster molts, its shell splits along the back. The lobster humps up through the opening in its old shell, draws its pincers back, its legs up, and its tail forward and out. The shell of the crab cracks around the middle, so that the crab can back out, pulling each leg from its sheath.

Before molting begins, most of the blood in the claws flows into the body, and lime in the joints of the claws dissolves. The muscles of the claws shrivel because of loss of blood and are able to pass through the small soft joints of the old shell. Sometimes there are accidents during molting. A leg or a feeler often breaks off. There is little pain and bleeding, however, because the limb usually breaks where there are few nerves and blood vessels. When the animal molts again, it grows a new limb. The new limb may be smaller at first, but usually becomes full sized after several molts. Eyes which are lost are often replaced by an extra feeler.

Scientific Classification. Crustaceans are the class *Crustacea*, phylum *Arthropoda*. J. LAURENS BARNARD

Related Articles in WORLD BOOK include:

Arthropod	Copepod	Fiddler Crab	Shrimp
Barnacle	Crab	Hermit Crab	Water Flea
Blue Crab	Crayfish	Lobster	

CRUX. See SOUTHERN CROSS.

CRUZEIRO is the monetary unit of Brazil. See MONEY (table: Values of Monetary Units).

CRYOBIOLOGY, *KRY oh by AHL uh jee*, is the study of how extremely low temperatures affect living things. Cryobiologists use temperatures that range from 0° C (32° F.), the freezing point of water, down to just above −273.15° C (−459.67° F.), which is absolute zero (see ABSOLUTE ZERO). The word *cryobiology* comes from the Greek *kryos* (icy cold) and *biology* (the science of living things).

Cryobiologists are chiefly concerned with freezing living matter to preserve it for future use. The freezing must be done rapidly to keep the cells alive. Cryobiologists use a liquid gas, usually nitrogen, to get temperatures far below normal freezing in a few seconds. Cells bathed in the liquid gas stop working. But they stay alive and unchanged in a state of "suspended animation." They can remain in this state without harm for long periods. After rapid thawing, the cells resume their normal work almost at once.

The rapid freezing of tissues such as skin, eye corneas, and blood makes it possible to store these parts in "banks." Doctors may use skin from such a bank to graft onto a badly burned patient. They use healthy corneas that have been stored to replace diseased or damaged ones. Blood banks previously could keep blood only for three weeks before it spoiled. But frozen whole blood can be stored indefinitely now.

In *cryosurgery*, surgeons use extreme cold to destroy tissue. For example, they can perform a "bloodless" operation by using special instruments equipped with *freezing tips*. When they insert the instrument tip into diseased tissue, the cooled tip kills the unwanted tissue. A shield around the remainder of the instrument protects healthy tissue.

Food industries use the techniques of cryobiology to preserve food. Manufacturers can freeze and store foods indefinitely without harming the flavor, consistency, or nutritional value. JOSEPH F. SAUNDERS

CRYOGENICS, *CRY oh JEHN icks*, is the study, development, and improvement of extremely low-temperature processes, techniques, and equipment. The temperatures range from −150° C (−238° F.) to near absolute zero, −273.15° C (−459.67° F.). The word *cryogenics* comes from the Greek word *kryos*, which means *icy cold*. Extremely low temperatures were first produced by making liquid air in the 1870's (see LIQUID AIR). In 1956, scientists reached the lowest temperatures yet. This was done by magnetizing copper nuclei at very low temperatures. When the magnet was turned off, the copper nuclei became demagnetized and cooled to temperatures within millionths of a degree of absolute zero.

The most common means of producing extremely low temperatures are with liquid hydrogen and liquid helium. Liquid hydrogen gives a temperature of about −253° C; liquid helium, −269° C. See HELIUM.

Many important advances have resulted from cryogenics, including the discovery of *superconductivity*. This is the ability of some metals to conduct electricity with no resistance at temperatures near absolute zero. Superconductivity can be destroyed if the metal or alloy is exposed to a magnetic field. See CRYOTRON.

Cryogenics has helped in the development of rocket fuels and in manufacturing steel. Also being developed in cryogenics are superconductive bearings with greatly reduced friction, electric motors with extraordinary efficiency, and magnetic lenses for electron microscopes. Cryogenics has contributed to producing sensitive electronic amplifiers and the creation of high magnetic fields for thermonuclear reactors. KLAUS D. TIMMERHAUS

See also SUPERCONDUCTIVITY.

CRYOLITE, *CRY oh lite*, is a soft mineral that often looks like snow ice. It is usually white, but sometimes has a bluish, reddish, or brown color. A cryolite solution is used in the electrolytic process by which aluminum is produced from bauxite ore. Cryolite is also used in making some sodium salts and ceramics, such as porcelain. It is a compound of aluminum, sodium, and fluorine and has the chemical formula Na_3AlF_6. The main cryolite deposits of commercial importance are at Ivigtut, Greenland. Eskimos call cryolite *ice stone*. See also ALUMINUM (Producing Aluminum). WILLIAM C. LUTH

CRYOSURGERY. See CRYOBIOLOGY; SURGERY (Technique).

CRYOTRON, *CRY oh trahn*, is a tiny electronic device that can be used as a switch or an amplifier. Cryotrons are only about $\frac{1}{10}$ inch (2.5 millimeters) long. They are so small that 100 of them will fit into an ordinary thimble. This makes it possible to greatly reduce the size of computers and other electronic apparatus.

Cryotrons work on the principle of *superconductivity*. This is the ability of some metals, such as lead, to conduct electric current with no resistance at temperatures below −420° F. (−215° C), or near absolute zero (see ABSOLUTE ZERO). A container of liquid helium surrounds cryotrons and cools them to these temperatures. However, a magnetic field can destroy superconductivity. This causes resistance to return to superconductive material so that little or no current will flow.

In a cryotron, a superconductive coil of fine wire is wound around another superconductive wire. A flow of current through the coil produces a magnetic field (see ELECTRICITY [Electricity and Magnetism]). The other wire will conduct current with no resistance so long as no current flows through the coil. By regulating the flow of current in the coil, the flow in the second wire can be turned on or off. In this way, a cryotron acts as a switch or amplifier. See ELECTRONICS.

Dudley A. Buck, a scientist at the Massachusetts Institute of Technology, began work on the cryotron in 1954, and completed it in 1957. JOHN ROBINSON PIERCE

CRYOVAC. See SARAN.

CRYPT, *krihpt*, is an underground room or vault. It usually refers to a vault under a church. The word comes from the Greek *kryptein* (to hide). Saints and martyrs were often buried in crypts. Chapels and altars were sometimes built over the spot where their bones were supposed to lie. One famous crypt is that of Saint Helena in Jerusalem. Legend says she found there the cross on which Christ died. Other famous crypts include those of Saint Peter's in Rome, of Saint Nicholas at Bari, of Canterbury Cathedral, and of Glasgow Cathedral. ALAN GOWANS

See also ALTAR; CATACOMBS.

CRYPTOGAM. See BOTANY (Terms).

CRYPTOGRAPHY. See CODES AND CIPHERS.

CRYSTAL. See GLASSWARE.

CRYSTAL AND CRYSTALLIZATION

CRYSTAL AND CRYSTALLIZATION. Living things, such as dandelions and dogs, grow from tiny seeds or eggs to a form that distinguishes them from other living things. Most nonliving substances, such as table salt, sugar, or ice, can also grow from a very small beginning into definite shapes. These shapes consist of smooth, flat surfaces that meet in sharp edges and corners. The process by which nonliving substances grow into bodies of such shapes is called *crystallization*, and the bodies themselves are called *crystals*. The study of crystals is called *crystallography*.

How Crystallization Takes Place. Anyone can see how crystals grow by making a simple experiment. Dissolve some ordinary salt in a glass of cold water. Put in more salt until some stays undissolved even after stirring and waiting. Then pour the clear salt solution into another glass. Lay a stick across the top of the second glass and from it let a piece of string hang down into the water. Let the glass stand in a place where it will not be disturbed. After a month or more, small clear cube-shaped salt crystals will have appeared on the string. Alum, which can be bought at a drugstore, produces crystals shaped like two pyramids with one base. This shows that nonliving things grow differently from living things. Living things grow from substances unlike themselves. They take food into their bodies and make it over into their own substance. But crystals merely add on new layers of their own substance.

How Crystals Are Built Up. From the way crystals grow, it is clear that they owe their shapes to the manner in which the atoms of which they consist are put together. The atoms of crystals are arranged in a regular geometric relation to one another. This arrangement is always the same for the same substance at the same temperature. The surfaces of a crystal are smooth and flat because the atoms are arranged in a definite pattern in rows upon rows throughout the entire crystal.

We cannot actually see the atoms arranged this way inside the crystal because they are so very small. But when X rays or electron beams are passed through a crystal, they reveal the pattern of the atoms by the way they come out on the other side. X-ray crystallography shows the arrangement of atoms below the crystal's surface. Scientists also use an *ion microscope* to "see" the atoms that form the surface of certain metal crystals. See Ion Microscope; X Rays (Uses).

Some minerals occur as masses of irregular crystal grains, and are not shaped like crystals on the outside. The individual grains do not have flat faces, because they touched other grains as they grew, rather than growing surrounded by a fluid. Such irregular crystal grains are said to be *anhedral*.

Classification of Crystals. Crystals are classified by the geometry of the crystal faces, or flat surfaces, that give them their shapes, especially by the angles in which adjoining crystal faces meet. By looking at only the simplest types of crystal forms we can understand one of the ways that crystals are classified.

The six basic types of crystals, illustrated with this article, make up the six *crystal systems*.

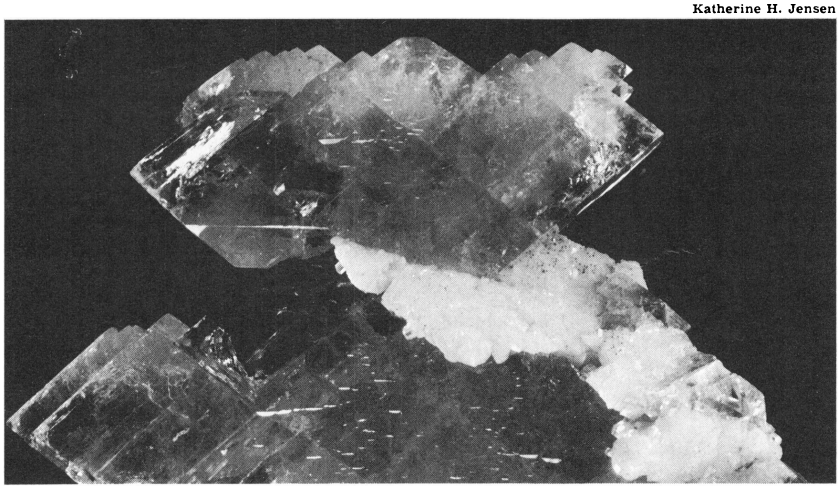
The Isometric System has a cube as its simplest form. In this system, each of the six faces is a square and all of them meet at right angles. In the illustration of the isometric system, the lower drawing shows a cube as it looks in nature. The upper drawing shows the same cube with three imaginary axes drawn on the inside. These axes are parallel to the edges of the cube. Corresponding axes are shown in the illustrations of the simplest forms of the other crystal systems.

Another common form of isometric crystal is the *octahedron*. It consists of a double four-sided pyramid, of which each face is an equilateral triangle. Galena, pyrite, alum, and garnet crystallize in this system.

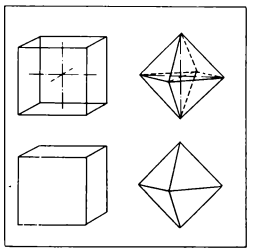
Orthorhombic System. In a simple orthorhombic crystal the left side, the right side, and the top are all rectangles. Not one of these is a square. But they meet at right angles. All three axes have different lengths. A pyramid-shaped orthorhombic crystal consists of *scalene* triangles, or triangles with three sides of different lengths. About 200 minerals crystallize in the orthorhombic system, including topaz, celestite, and chalcocite.

Tetragonal System. The simplest type of tetragonal crystal is a prism in which the sides are rectangles, and the top and bottom are squares. All faces of this crystal meet at right angles. Generally, the upright axis is longer or shorter than the other two axes, which are equal in length. In the tetragonal pyramid, the sides are identical isosceles triangles. Such minerals as cas-

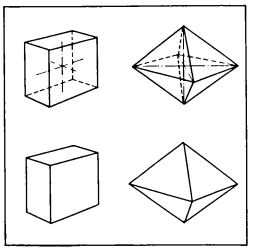
Katherine H. Jensen



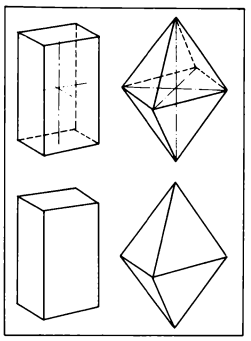
Crystals of Barite, a common barium sulfate mineral and an important ore of barium, belong to the orthorhombic system.



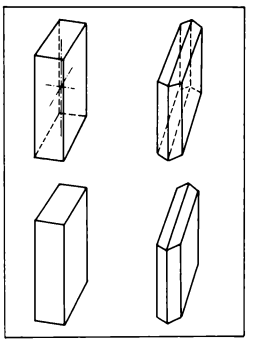
Isometric Crystals have 3 axes, all at right angles and of equal length. Gold forms such crystals.



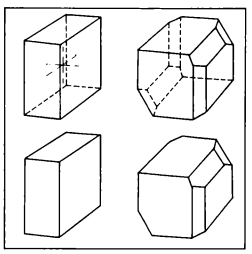
Orthorhombic Crystals have 3 axes at right angles and of unequal lengths. Topaz has such crystals.



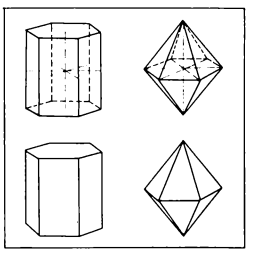
Tetragonal Crystals have 3 axes. All of them are at right angles. Two of the axes are equal in length.



Monoclinic Crystals have 3 axes, 2 at an angle different from 90°, the third perpendicular to them.



Triclinic Crystals have 3 axes, all inclined and of different lengths. Copper sulfate has such crystals.



Hexagonal Crystals have 4 axes, 3 at 120° angles, the fourth at right angles to them and longer or shorter.

siterite and rutile crystallize in the tetragonal system.

Monoclinic System. In a simple monoclinic crystal, four sides consist of rectangles and two of parallelograms. But only the left and right sides meet the top and bottom surfaces at right angles. The top and bottom surfaces are inclined, instead of being horizontal as they are in the first four systems. The monoclinic system is one of the commonest, and includes borax, muscovite, hornblende, and azurite crystals.

Triclinic System. In triclinic crystals, the faces generally do not meet at right angles. Only a few minerals crystallize in the triclinic system.

Hexagonal System. In this system, prisms consist of six sides or of three sides, instead of four as in the other systems. The sides meet the top and bottom surfaces at right angles. Three of the four corresponding axes are equal. The fourth is longer or shorter. The hexagonal pyramid has six sides. The system includes beryl, tourmaline, hematite, and calcite crystals. GEORGE TUNELL

See also GEM; MINERAL; QUARTZ; SNOW; LIQUID CRYSTAL.

CRYSTAL BALL. See FORTUNETELLING.

CRYSTAL PALACE. See FAIRS AND EXPOSITIONS.

CRYSTAL SET. See RADIO (How Radio Programs Are Received; picture: a "Crystal" Radio).

CRYSTALLINE LENS. See EYE (The Eyeball).

CRYSTALLINE ROCKS consist of countless crystals of one or several kinds of minerals grown together solidly. In granite and some other crystalline rocks, the crystals can be seen with the unaided eye. But in other types, the crystals are so small that a viewer must use a magnifying glass or microscope to see them. Crystalline rocks form in various ways. For example, molten rock solidifies into crystals as it cools. Travertine, a type of limestone, forms from calcite (calcium carbonate) crystals precipitated from ground water. Earth pressures and heat turn fine-grained limestone into marble by coarsening the crystal structure. See also LIMESTONE; ROCK. A. J. EARDLEY

CRYSTALLOGRAPHY. See CRYSTAL AND CRYSTALLIZATION.

CTENOPHORE, *TEEN uh for*, is a small transparent sea animal that lives in all the oceans of the world. Ctenophores are also called *comb jellies* and *sea walnuts*. The ctenophore body may be shaped like a ball, a thimble, or a belt. It looks a little like a jellyfish. The size of most *species* (kinds) varies from that of a pea to a thimble. One species, called *Venus's-girdle*, is shaped like a belt and may grow over 3 feet (91 centimeters) long.

Ctenophore means *a comb bearer*. The animal gets this name from the eight bands of comblike organs on the sides of its body. The combs are made of groups of *cilia* (tiny hairlike structures). Ctenophores move slowly through the water by beating these cilia. In some species, the combs give off flashes of light.

Scientific Classification. Ctenophores make up the phylum *Ctenophora*. ROBERT D. BARNES

CTESIBIUS. See INVENTION (Ancient Greece).

CUAUHTÉMOC, *kwow TEHM ohk* (1495?-1525), was the last Aztec Indian ruler of Mexico. He defended the Aztec capital, Tenochtitlán (now Mexico City), against the Spanish conqueror Hernando Cortes. The fall of Tenochtitlán in 1521, after a long siege, marked the end of the Aztec civilization.

Cuauhtémoc became ruler of the Aztecs in 1520, four months after the death of his uncle, Emperor Montezuma II. In 1525, Cortes had Cuauhtémoc killed because he believed the Indian leader was plotting against the Spaniards.

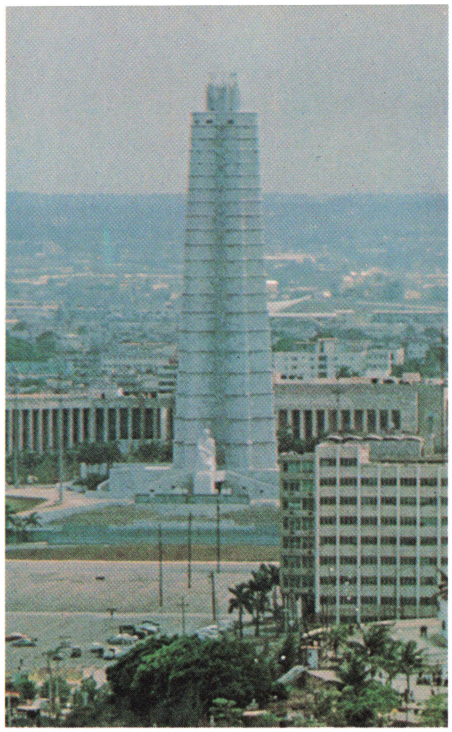
Today, Mexicans honor Cuauhtémoc as a national hero because of his bravery in the defense of Tenochtitlán. Mexican Americans admire him as a symbol of their struggle for civil rights. FELICIANO RIVERA

CUB. See BEAR; LION; TIGER.

CUB SCOUT. See BOY SCOUTS.

WORLD BOOK photo by Ron Laytner

Workers Harvest Sugar Cane on a government-owned farm in central Cuba. Sugar is Cuba's chief crop.



J. A. Hancock, Photo Researchers

The José Martí Monument rises 450 feet (137 meters) above the Plaza de la Revolución in Havana.

CUBA

CUBA, *KYOO buh,* is an island country in the West Indies, about 90 miles (140 kilometers) south of Florida. It consists of one large island and more than 1,600 smaller ones. Few people live on any of the smaller islands except the Isle of Pines. Cuba is almost as large as Pennsylvania and has about four-fifths as many people. Havana is the capital and largest city.

Cuba is one of the most beautiful islands in the Antilles, a part of the West Indies island group. Cubans call their country the *Pearl of the Antilles.* Towering mountains and rolling hills cover about a fourth of the island. The rest of Cuba consists mainly of gentle slopes and broad grasslands. Cuba has a magnificent coastline marked with deep bays, sandy beaches, and colorful coral reefs.

Cuba has a long history of struggle for independence and social reform. For about 400 years, Spain ruled Cuba. During this period, many Cubans died in revolts against Spanish rule. In 1898, the United States helped defeat Spain in Cuba's struggle for independence. Spain then gave up all claims to Cuba, and a U.S. military government ruled the island until 1902. During the 1930's, Cuba came under the control of a dictator, Fulgencio Batista. In 1959, Fidel Castro and a band of rebels overthrew Batista. They later set up a socialist government, with Castro as prime minister. Today, the Cuban government is highly centralized, and Castro has strong control over its policies. The government allows only one political party, the Cuban Communist Party.

Robert Freeman Smith, the contributor of this article, is Professor of History at the University of Toledo and the author of Background to Revolution: The Development of Modern Cuba.

The Castro government provides many benefits for the people, including free medical care and free education. But Cuba's economy has developed slowly under Castro. The output of some industries has declined, and government attempts to increase agricultural production have been only partly successful.

Relations between Cuba and the United States became tense soon after the Castro revolution. In 1961, the United States ended diplomatic relations with Cuba. The United States maintains a naval base on the island at Guantánamo Bay. Cuban leaders resent the presence of the base, but the United States refuses to give up Guantánamo.

FACTS IN BRIEF

Capital: Havana.

Official Language: Spanish.

Area: 44,218 sq. mi. (114,524 km²). *Greatest Distances*—northwest-southeast, 759 mi. (1,221 km); north-south, 135 mi. (217 km). *Coastline*—2,100 mi. (3,380 km).

Elevation: *Highest*—Pico Turquino, 6,542 ft. (1,994 m). *Lowest*—sea level.

Population: *Estimated 1976 Population*—9,470,000; distribution, 60 per cent urban, 40 per cent rural; density, 215 persons per sq. mi. (83 per km²). *1970 Census*—8,553,395. *Estimated 1981 Population*—10,456,000.

Chief Products: *Agriculture*—cattle, citrus fruits, coffee, pineapples, sugar cane, tobacco, vegetables. *Manufacturing*—cement, cigarettes, cigars, fertilizers, refined sugar, rum, textiles. *Mining*—chromite, iron, limestone, manganese, nickel.

National Anthem: "La Bayamesa."

National Holiday: July 26, the anniversary of Fidel Castro's attack on the Moncada Army Barracks.

Money: *Basic Unit*—peso. For the value of the peso in dollars, see MONEY (table: Values). See also PESO.

A 23-member Council of Ministers rules Cuba by *decree* (command) and directs the activities of the various government departments at both the national level and the local level. Fidel Castro heads the council as prime minister and appoints all its members. He thus has wide control over government policies.

The Cuban government has two major goals: (1) economic development and (2) political and social equality among the people. Economic development has been slow. But the government has made great progress toward its second goal.

The government allows only one political party, the Cuban Communist Party. It has about 125,000 members and is headed by Castro. The party has little voice in national affairs, but party leaders hold the most important offices in local government.

Local Government. Cuba is divided into 6 provinces. Within the provinces, there are 43 regions and about 320 cities and towns. The Council of Ministers and the Communist Party select officials to govern each province. Party leaders appoint a president to administer each region and a mayor to oversee each city and town, except Havana.

Cubans take an active part in community projects and local government. At annual or semiannual meetings called *asambleas*, they may discuss plans for building new schools, sewers, and other projects. They may also join neighborhood committees that sponsor political and social service activities. These committees are called *committees for the defense of the revolution*. In addition, Cubans elect officials to take charge of building and maintaining parks, restaurants, social centers, and other facilities. These officials serve for one year.

Courts. The Cuban court system includes *revolutionary tribunals* and *popular tribunals*. Revolutionary tribunals hear serious cases against the government, such as charges of treason and political *corruption* (dishonesty). Popular tribunals are informal courts conducted by the citizens of a community. These courts hear most criminal and civil cases.

Armed Forces. Cuba has one of the largest and best-equipped armies in Latin America. About 200,000 men serve in the country's regular armed forces, and about 100,000 men and women are in the militia reserve army. The armed forces perform many nonmilitary services, such as harvesting sugar cane and clearing farmland. Cuban men must serve three years of active duty after they reach the age of 15, unless they volunteer for three years of farm work.

GOVERNMENT IN BRIEF

Form of Government: Dictatorship.
Political Divisions: 6 provinces, 43 regions, about 320 cities and towns.
Head of State: President.
Head of Government: Prime minister.
National Governing Body: A 23-member Council of Ministers rules by decree. Castro appoints all members of the council.
Local Government: The Council of Ministers and the Cuban Communist Party select the chief administrators of the provinces. Party leaders appoint the heads of the regions and the cities and towns.

Fred Mayer from Woodfin Camp

Prime Minister Fidel Castro speaks to a large audience in Havana. A huge poster of Ché Guevara and Camilo Cienfuegos, leaders in the 1959 revolution, is displayed in the background.

Cuba's Flag was officially adopted in 1902, shortly after Cuba became a republic. The star stands for independence.

Coat of Arms. The key means Cuba is the key to the Gulf of Mexico. The stripes are from the flag.

WORLD BOOK map

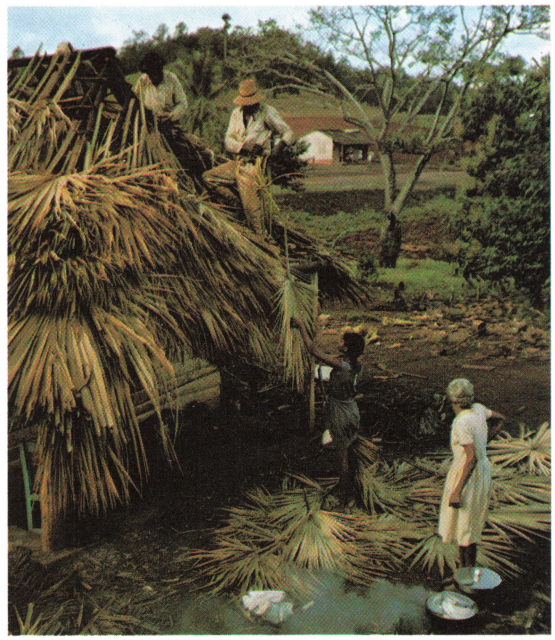
Cuba lies about 90 miles (140 kilometers) south of Key West, Fla. It is slightly smaller than Pennsylvania.

Population and Ancestry. Cuba has a population of about 9½ million. About three-fifths of the people live in cities and towns. Havana, the capital and largest city, has over 1½ million persons. One other city—Santiago de Cuba—has more than 250,000 persons. See the separate articles on Cuban cities listed in the *Related Articles* at the end of this article.

About 500,000 Cubans have left their homeland since the 1959 revolution. The great majority of these people were businessmen, political officials, and professional persons. Most of them moved to the United States. Others settled in Mexico, Puerto Rico, and Spain.

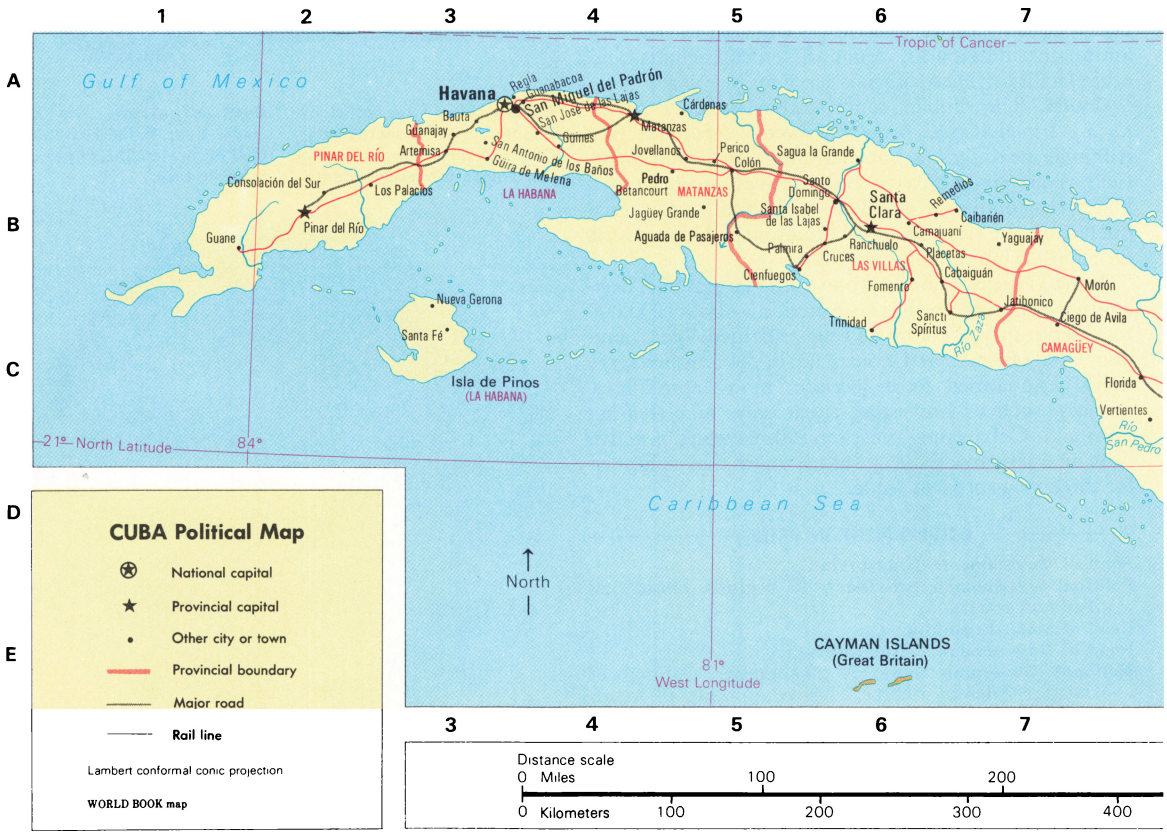
According to Cuban government records, about 75 per cent of the people are white and of Spanish descent. Most of the rest are Negroes or *mulattoes* (persons of mixed Negro and white ancestry). But many of the people listed as white have a mixed ancestry. Almost all Cubans speak Spanish. Some people, especially in the cities, also speak English. Some of the Negroes also speak an African language called *Yoruba*.

Way of Life. About 40 per cent of the Cuban people live in rural areas. Many of them are poor. Before the Castro revolution, Cuba's government used much of the nation's economic resources to help make Havana one of the world's most luxurious and popular tourist centers. But little was done to improve life in the rural areas, where many people lived largely on roots, sugar cane, and other plants. Today, Castro's government has



Fred Mayer from Woodfin Camp, Inc.

Thatch-Roofed Houses are common in rural areas of Cuba. Many families use palm leaves to thatch their houses.



turned much of its attention from Havana and spends large sums of money to provide food, housing, and education for the rural people.

Cuba has a severe housing shortage. In the cities, most people live in crowded apartment buildings. Two or more families may share an apartment. A large number of country people live in thatch-roofed huts, many of which have cement floors. The government has built some new housing, but not enough to meet the demand.

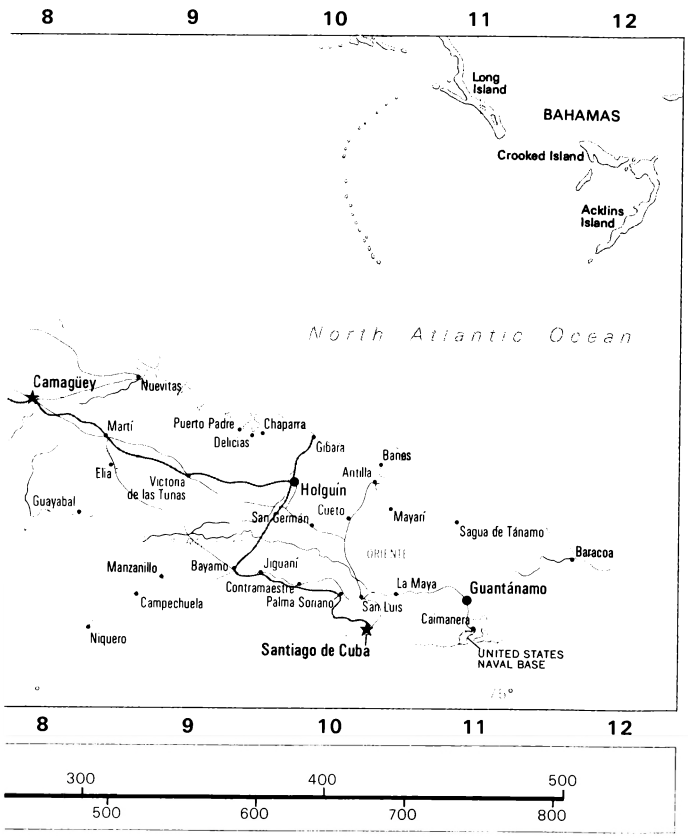
Many types of food are scarce in Cuba and must be *rationed* (sold in limited amounts). Shoppers stand in long lines to buy such foods as eggs and meat. In spite of the shortages, most Cubans get enough to eat. Children receive 1 quart (0.9 liter) of milk a day, and workers get one or two free meals a day at their jobs.

Cubans have a strong love for their country and its traditions. In addition, the government encourages extreme *nationalism* (patriotism) among the people. Throughout Cuba, posters and neon lights display the revolutionary motto *Patria o Muerte, Venceremos* (Fatherland or Death, We Shall Conquer).

Most Cubans enjoy singing and dancing, especially to the lively folk music of the island. Popular Cuban dances include the cha-cha-cha, the mambo, and the rumba. Young Cubans enjoy rock music. Cubans are also enthusiastic sports fans. Favorite sports include baseball, basketball, swimming, and track and field.

Fred Mayer from Woodfin Camp

Free Hot Lunches, often consisting of rice, beans, and meat, are served daily to Cuban schoolchildren.



Provinces

CAMAGÜEY	C	7
Pop.	813,204	
LA HABANA	A	3
Pop.	2,335,344	
LAS VILLAS	B	6
Pop.	1,362,179	
MATANZAS	B	5
Pop.	501,273	
ORIENTE	D	10
Pop.	2,998,972	
PINAR DEL RÍO	B	2
Pop.	542,423	

Cities and Towns

Alquizar*	11,519	A	3
Amancio Rodríquez*	12,264	D	8
Artemisa	31,234	A	3
Banes	27,090	D	10
Baracoa	20,926	D	12
Batabanó*	11,533	B	3
Bauta	21,147	A	3
Bayamo	71,660	D	9
Bejucal*	15,446	A	3
Cabaiguán	21,657	B	6
Caibarién	27,030	B	7
Camagüey	196,854	C	8
Camajuaní	15,945	B	6
Cárdenas	55,209	A	5
Ciego de Avila	60,910	C	7
Cienfuegos	85,248	B	5
Colombia*	11,001	D	8
Colón	25,986	B	5
Consolación del Sur	15,126	B	2
Contramaestre	22,943	D	10
Cruces	19,057	B	6
Cumanayagua*	10,695	C	6
Delicias	10,562	C	9
Florida	32,679	C	8
Fomento	12,923	B	6
Gibara	12,088	C	10
Guanajay	18,823	A	3
Guantánamo	130,061	E	11
Güines	41,409	A	4
Güira de Melena	19,851	B	3
Havana (La Habana)	1,755,360 *1,970,773	A	3
Holguín	131,508	D	10
Jiguaní	10,752	D	9
Jovellanos	16,548	B	5
Managua*	10,671	C	6
Manzanillo	77,880	D	9
Mariel*	11,897	A	3
Matanzas	85,376	A	4
Mayarí	17,621	D	10
Moa*	14,965	D	11
Morón	28,981	B	7
Niquero	11,344	E	8
Nueva Gerona	17,175	C	3
Nuevitas	20,734	C	9
Palma Soriano	41,188	E	10
Palmira	10,877	B	5
Pedro Betancourt	10,953	B	5
Pinar del Río	73,206	B	2
Placetas	32,261	B	6
Puerto Padre	16,539	C	9
Ranchuelo	12,992	B	6
Remedios	13,121	B	6
Sagua la Grande	35,809	B	6
San Antonio de los Baños	25,339	A	3
San Cristóbal*	15,674	B	3
San Germán	12,362	D	10
San José de las Lajas	24,927	A	4
San Juan y Martínez*	11,121	B	2
San Luis	17,370	E	10
San Nicolás de Bari*	10,957	B	4
Sancti Spíritus	57,703	C	6
Santa Clara	131,504	B	6
Santa Cruz del Sur*	10,783	D	8
Santiago de Cuba	275,970	E	10
Trinidad	31,474	C	6
Vertientes	13,953	C	8
Victoria de las Tunas	53,739	D	9

*Does not appear on map; key shows general location.
*Population of metropolitan area, including suburbs.
Source: Census figures (1970).

Education. Cuban law requires children to go to school for at least six years. The government controls the schools, and education is free. About 1½ million students attend elementary and high school. About 35,000 students go to the country's three national universities, located in Havana, Santa Clara, and Santiago de Cuba.

The government has set up various adult education programs. During the early 1960's, it recruited students to teach uneducated Cubans how to read and write. Later, other education projects were established. As a result of these programs, a great number of adults have completed elementary school. Many adults attend night school and job-training classes.

Religion. Most Cubans belong to the Roman Catholic Church. But the church has always been weak in Cuba, and few people attend services regularly. The government has taken over almost all church schools and has forced many priests to leave the country.

Some Cubans believe in *Santería*, a religion that combines African tribal and Roman Catholic ceremonies. Its followers regard themselves as Catholics. They believe that Catholic saints represent African gods. Other religious groups in Cuba include Episcopalians, Jehovah's Witnesses, and Methodists.

The Arts. The Cuban government strongly supports the arts and sponsors free ballets, plays, and other cultural events. The government also provides scholarships for talented youths to the Cubanacan, a Havana center for the fine arts. The Casa de las Américas, a government-controlled publishing company, is the center of literary activity. It publishes a literary magazine, novels, poetry, and textbooks.

The works of many of Cuba's greatest writers have attacked political and social injustice. During the 1800's, Cuba's struggle for independence from Spain inspired such writers as José Martí and Rafael Mendive. During the 1900's, the poet Nicolás Guillén, the novelist Alejo Carpentier, and other writers have described the bitter hardships of the lower classes. Also during the 1900's, Fernando Ortiz became famous for his studies of Negro customs and of the Cuban sugar and tobacco industries. Since the Castro revolution, several young writers have become popular. They include the novelist Edmundo Desnoes and the poet Herberto Padilla. The government places few restrictions on Cuban authors. But some officials have criticized writers for not using revolutionary themes in their works.

During the 1900's, Cuban sculptors and painters have produced many outstanding works. The best-known sculptors include Teodoro Ramos Blanco and Juan José Sicre. Cuban painters have become known for their landscapes and portrayals of daily life. Leading artists include Wilfredo Lam and Cundo Bermúdez.

Cuban composers have combined African and European musical traditions in their works. Musicians use bells, bottles, castanets, and drums to produce the unusual beat of Cuban music. Famous composers of the 1900's include José Ardévol and Alejandro García Caturla.

WORLD BOOK photo by Ron Laytner

World-Famous Havana Cigars rank among Cuba's leading exports. The best cigars are made from tobacco grown in the Vuelta Abajo region in northwestern Cuba. These skilled workers roll the cigars by hand, the traditional method of making high-quality cigars.

CUBA / *The Land*

Cuba lies about 90 miles (140 kilometers) south of Key West, Fla. The Cuban mainland is the largest and westernmost island in the West Indies. The mainland and its surrounding islands cover 44,218 square miles (114,524 square kilometers).

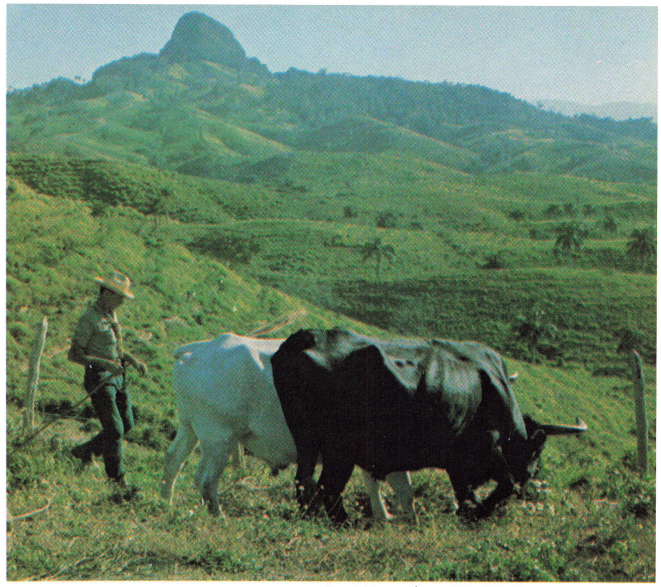
Surface Features. Cuba has a varied landscape. Mountains and hills cover about a fourth of the island. The rest of Cuba consists chiefly of gentle slopes, rolling plains, and wide, fertile valleys.

Cuba has three main mountain ranges—the Sierra de los Órganos in the northwest, the Sierra de Trinidad in central Cuba, and the Sierra Maestra in the southeast. The highest point in Cuba, the Pico Turquino, rises 6,542 feet (1,994 meters) in the Sierra Maestra. Heavy forests, consisting chiefly of pine trees, cover the mountain regions of southeastern Cuba.

Rich croplands and pasturelands lie between the mountain ranges. This fertile soil consists mainly of red clay. Western and central Cuba have sandy areas. Stretches of lowlands and swamps lie along the coasts. Central Cuba has some limestone hills with large caves.

Rivers. Cuba has more than 200 rivers and streams. Most of them are short and narrow and too shallow for navigation. The longest river, the Cauto, flows about 150 miles (241 kilometers) through the southeastern part of the country. It is navigable for only about 75 miles (121 kilometers). Many of the rivers and streams in the mountain regions have waterfalls.

Coastline and Islands. Cuba's coastline measures 2,100 miles (3,380 kilometers) long. It is marked with deep bays and sandy beaches and is fringed with coral islands and reefs. About 200 harbors lie along the coast.



Fred Mayer from Woodfin Camp

A Farmer Tends His Oxen in Pinar del Río, a province in western Cuba known for its rich soil and low, rolling hills.

Most of the harbors have narrow entrances, which protect the inner area against winds and waves. The most important harbors include Havana and Nuevitas on the north coast and Cienfuegos, Guantánamo, and Santiago de Cuba on the south coast.

More than 1,600 islands surround the Cuban mainland. The largest island, the Isle of Pines, lies about 40 miles (64 kilometers) off the southwest coast. It has an area of about 1,180 square miles (3,056 square kilometers). Forests cover the northern and southern parts of the Isle of Pines, and flat marshes lie in the center.

CUBA Physical Map

Numerous coral reefs and small islands form bays along the Cuban coast. Cuba also has many small rivers. Pico Turquino, the country's highest mountain, rises in the Sierra Maestra.

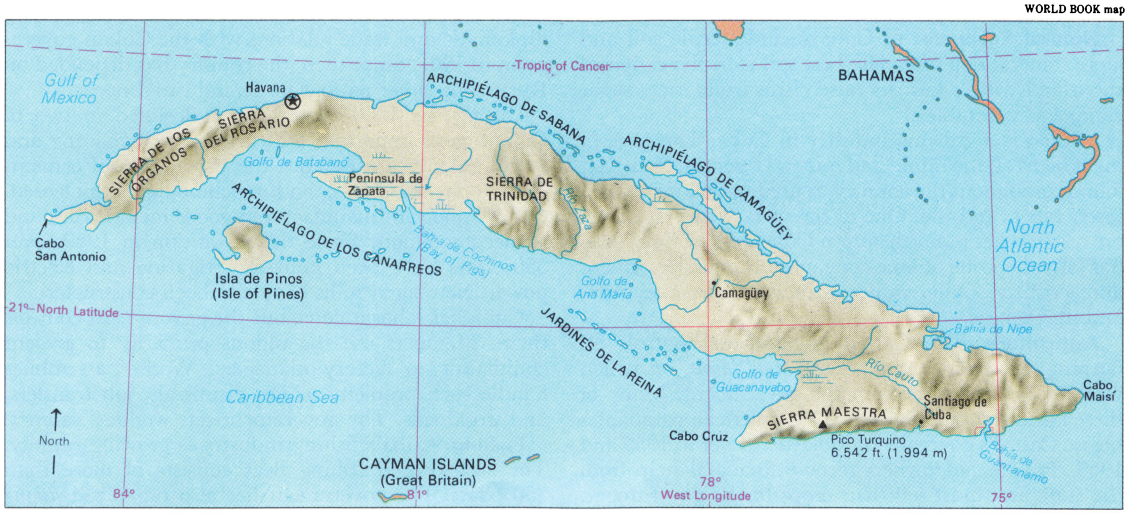
Distance scale
0 100 200 Miles
0 100 200 Kilometers

Geographical Terms

Archipiélago	islands
Bahía	bay
Cabo	cape
Golfo	gulf
Pico	mountain
Río	river
Sierra	mountain range

National capital
Other city or town
Mountain peak
Swamp
River

WORLD BOOK map

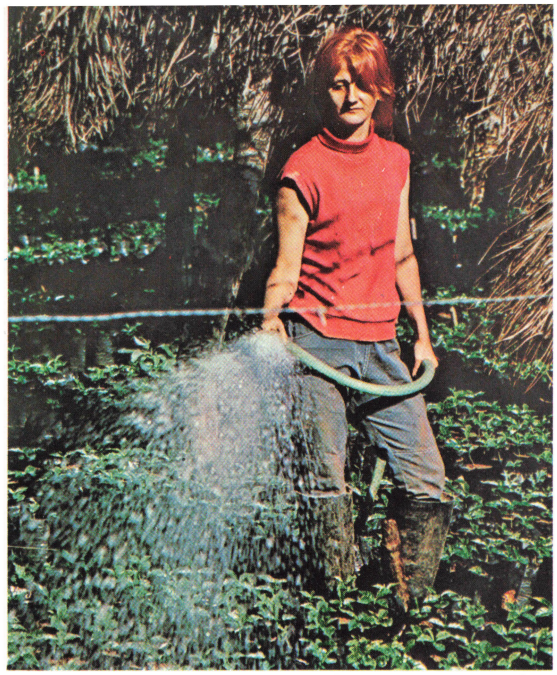


CUBA / *Climate*

Cuba lies within the northern tropics and has a semitropical climate. Cool ocean breezes from the northeast during the summer and warm breezes from the southeast during the winter give the island a mild climate the year around. Average daily temperatures range from about 70° F. (21° C) in winter to about 80° F. (27° C) in summer. The interior has a greater temperature range than the coastal regions. But temperatures in the interior rarely fall below 50° F. (10° C) or rise above 90° F. (32° C). Frosts sometimes occur in the mountains.

Cuba has a dry season and a rainy season. The dry season lasts from November through April, and the rainy season runs from May through October. The country has an average annual rainfall of 54 inches (137 centimeters). Thunderstorms occur almost daily in summer. Cuba has occasional dry periods during which not enough rain falls to produce sufficient juice in the country's sugar cane. Sugar is made from this juice.

Violent hurricanes hit the island frequently, particularly the western half, during August, September, and October. The strong winds occasionally destroy buildings and crops and create high waves that flood the coastal lowlands.



J. A. Hancock, Photo Researchers

Coffee Trees, like many other tropical and subtropical plants, thrive in Cuba's mild climate and fertile soil.

CUBA / *Economy*

The government plans and controls Cuba's economy. It owns all industries, banks, and small businesses. The government also owns more than 70 per cent of the farmland. The rest of the farmland is privately owned. Cuba is a member of the Council for Mutual Economic Assistance (COMECON), an economic union made up of Russia and other Communist nations.

The Cuban economy has been developing slowly. During the early 1960's, the government began a program to industrialize the country. This program was only partly successful because of a lack of funds and raw materials. The government then shifted its emphasis to agriculture, especially the production of sugar. But dry periods, hurricanes, and planning errors have limited the success of the program.

Natural Resources of Cuba include fertile soil and large mineral deposits. The best soil is in the center of the island, where farmers raise citrus fruits, rice, sugar cane, and vegetables.

Mining is a growing industry in Cuba. The government owns all the mines and mineral reserves. Red clay, found throughout the country, is used in making bricks, sewer pipes, and tile. One of the world's largest nickel ore reserves lies in northeastern Cuba. The country also has large deposits of limestone, used in making cement and fertilizer. Other minerals include chromite, iron, and manganese.

Agriculture. The Cuban government controls all farming. It operates many large *state farms*, on which workers collect wages from the government. Many of these farms were estates owned by American companies before Castro's government took them over in 1959 and 1960. Private landowners receive financial help from the state and must sell their crops to the government. The size of their farms may not be more than 166 acres (67 hectares).

Sugar has long been Cuba's chief crop. It is grown throughout the island, but the largest crops come from eastern Cuba. Tobacco, the country's second most important crop, comes mainly from the Vuelta Abajo district in northwestern Cuba. Other farm products include bananas, citrus fruits, coffee, pineapples, rice, and vegetables. Cattle raising has increased as a result of the government's agricultural program.

Manufacturing. Before the Castro revolution, American companies owned most Cuban industries, and almost all factory machinery and raw materials came from U.S. suppliers. In 1960, the government seized all American-owned industries. The United States broke diplomatic and trade relations with the Cuban government in 1961. Since then, the country has depended on Russia and other nations for its industrial needs.

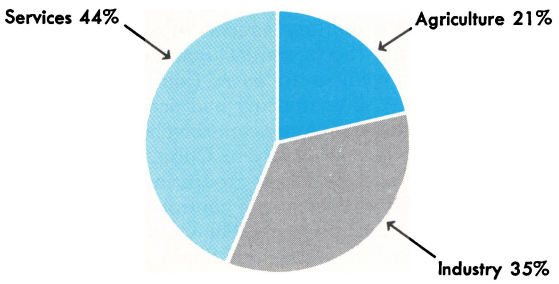
During the 1960's, production declined in two of Cuba's most important industries—sugar refining and textile manufacturing. But the production of cement, farm tools, fertilizers, and machine parts increased. Other important manufactured goods include rum and tobacco products. Since the revolution in 1959, over 350 dams have been built for irrigation and electric power. New sugar mills have also been constructed.

Cuba has labor unions, but the government controls them. Members use the unions primarily to present complaints to factory managers. Worker assemblies handle such problems as job dismissals, job transfers, and workloads. The government sets workers' salaries.

Fishing. Cuba's fishing industry is growing rapidly. The state-owned fishing fleet consists of more than 350 boats. The government has also organized *fishing*

CUBA'S GROSS NATIONAL PRODUCT IN 1968

Total gross national product—$5,280,000,000



The gross national product (GNP) is the total value of goods and services produced by a country in a year. The GNP measures a nation's total economic performance for the year. It can also be used to compare the economic output and growth of countries.

Production and Workers by Economic Activities

Economic Activities	Per Cent of GNP Produced	Labor Force*	
		Number of Persons	Per Cent of Total
Services & Government	37	835,000	34
Manufacturing, Mining, & Utilities	29	510,000	21
Agriculture, Forestry, & Fishing	21	830,000	34
Transportation & Communication	7	125,000	5
Construction	6	150,000	6
Total	100	2,450,000	100

*1965, latest information available
Source: Official Cuban government data

cooperatives, in which the members share in the profits. Major Cuban fishing ports include Caibarién, Cienfuegos, and Havana.

Trade. About half of Cuba's trade is with Russia. Other trading partners include Bulgaria, Canada, China, Czechoslovakia, Great Britain, Japan, and Spain. Cuba spends more on imports than it collects on exports. Since the early 1960's, Russia has lent Cuba over $350 million a year to make up the difference.

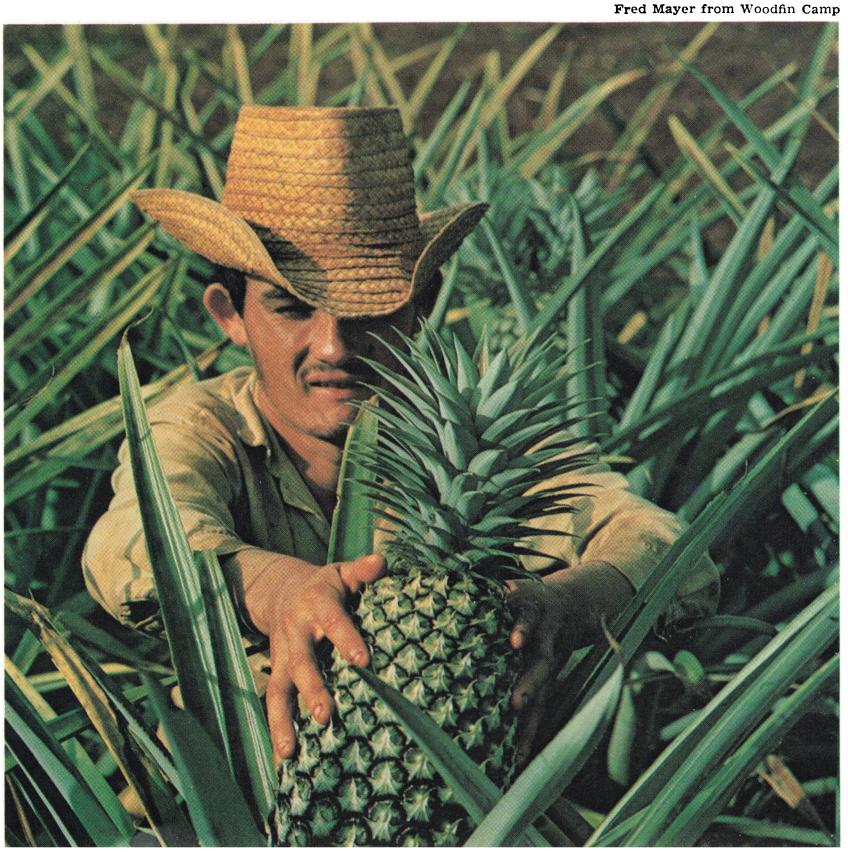
Cuba's chief exports are sugar and refined nickel ore. The country also exports rum, tobacco, and tobacco products. Cuba's main imports include machinery and petroleum products.

Transportation and Communication. Cuba has more than 8,000 miles (13,000 kilometers) of roads. The main road, the Central Highway, extends 706 miles (1,136 kilometers), from Pinar del Río to Santiago de Cuba. Few Cubans have automobiles. Most of the people travel by bus.

The country has more than 11,000 miles (17,700 kilometers) of railroad track. But about 65 per cent of the track consists of short lines that connect the sugar mills to the main rail lines. The state airline, Cubana, flies within Cuba. It also operates some international flights. José Martí International Airport in Havana is the country's largest airport.

Telegraph and telephone lines connect the major Cuban cities. Many Cuban homes do not have telephones, but the government has installed free public telephone booths in many cities. The government controls Cuba's 147 radio stations, 19 television stations, and 10 daily newspapers. Cubans can pick up radio and television broadcasts from the United States.

Fred Mayer from Woodfin Camp



Pineapples are picked by a Cuban farm worker. Pineapples rank as one of Cuba's most important products. Central Cuba produces the nation's largest pineapple crops.

Early Years. Christopher Columbus landed in Cuba in 1492 and claimed it for Spain. Spaniards began to settle the island in 1511, and Cuba soon became one of the richest colonies in the West Indies. Most of the settlers took up farming. They grew sugar and tobacco on large plantations and forced the native American Indians to work in the fields. Many Indians died from diseases and harsh treatment. As the Indian population declined, the Spaniards began to import African slaves. The first African slaves arrived in Cuba in 1517.

From the mid-1500's to the late 1700's, Cuba developed slowly. Pirates raided the coasts frequently, and many colonists moved to South America.

During the late 1700's, Cuba grew prosperous again. Havana became a commercial center as its port developed into a shipyard and naval base. Sugar and tobacco production increased, and Cuba began to sell its products to the British colonies of North America.

Cuban plantation owners imported more and more slaves during the late 1700's and early 1800's. Many owners treated their slaves brutally. In 1812, a group of slaves, headed by José Antonio Aponte, planned a revolt. The Spaniards discovered the plot and hanged Aponte and his followers.

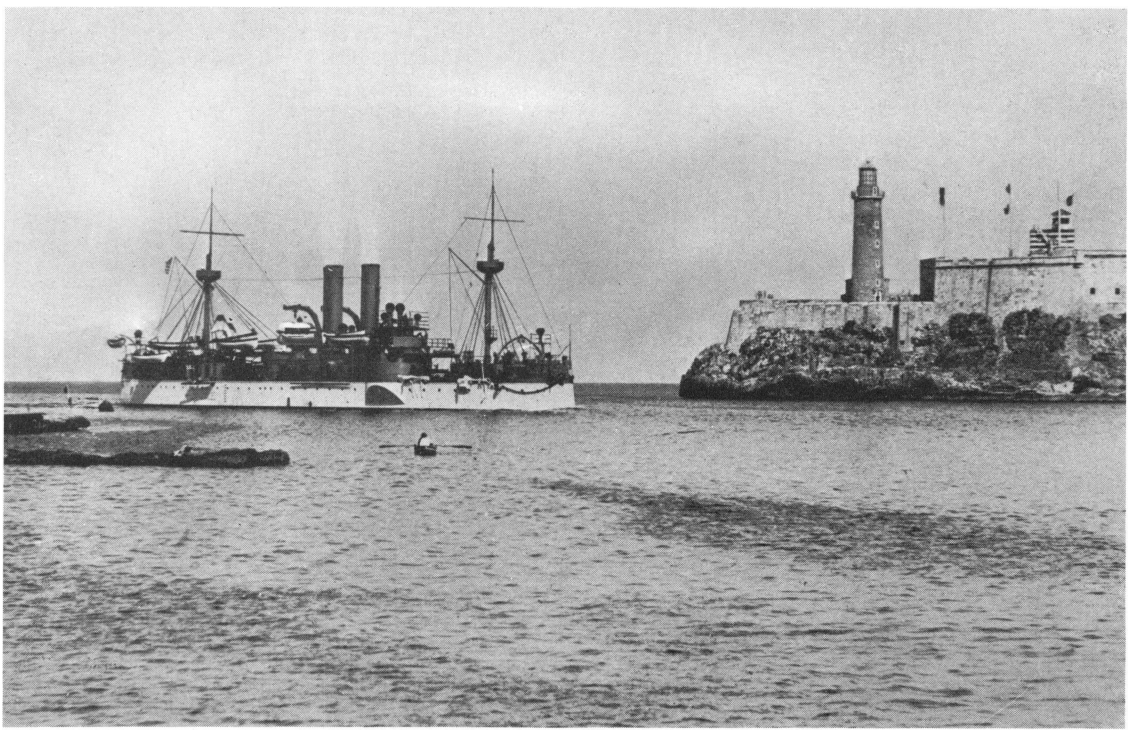
Struggle Against Spain. During the 1800's, various Cuban groups plotted revolts against the Spanish rule of their country. In 1821, José Francisco Lemus organized the first important revolutionary movement. But it collapsed by 1826. About the same time, Simón Bolívar, a South American general, and several Mexican leaders organized an army to invade Cuba and Puerto Rico and free them from Spain. The United States warned that it would support Spain against the invasions, and the military leaders dropped their plans.

During the mid-1800's, some Cubans and Americans supported a movement to *annex* (join) Cuba to the United States. A slave uprising had occurred in Cuba in 1844. Cuban and American slaveholders, fearing that Spain would end slavery in Cuba, supported the annexation movement. Other groups in Cuba and the United States favored American control of the island for economic and military reasons. The United States made several offers to buy Cuba, but Spain rejected them.

Cuba's struggle against Spanish rule led to the outbreak of the Ten Years' War in 1868. Carlos de Céspedes, a wealthy planter, headed a revolutionary group that demanded independence and the abolition of slavery. Spain rejected the group's demands, and fighting followed. The war ended with the signing of the Pact of Zanjón in 1878. This treaty provided for the gradual abolition of slavery and political reforms.

Slavery was ended in Cuba in 1886, but many Cubans still wanted independence for their country. A revolution, led by José Martí, broke out in 1895. Thousands of Cubans died in the fighting. But by 1898, Spain controlled only the major coastal cities of Cuba.

President William McKinley of the United States believed that the fighting on the island threatened



National Archives

The U.S. Battleship *Maine* arrived in Havana in 1898 to protect Americans during Cuba's fight for freedom from Spain. The ship exploded mysteriously, triggering the Spanish-American War.

American interests. He told the Spanish government to either crush the revolution or give up Cuba. In February, 1898, the U.S. battleship *Maine*, which was sent to Havana to protect Americans in Cuba, exploded mysteriously. The United States blamed Spain for the explosion and, in April, declared war on Spain. Cuba's struggle for independence thus became known as the Spanish-American War. The Spanish army surrendered in August. Under the Treaty of Paris, signed on December 10, Spain gave up all rights to the island. The United States then set up a military government in Cuba. The presence of U.S. forces angered many Cubans and Americans. See SPANISH-AMERICAN WAR.

United States Control. Cuba experienced some development under U.S. military rule. General Leonard Wood governed Cuba from 1899 to 1902. He began an important public works program.

For many years, a deadly disease called yellow fever had plagued the Cuban people. In 1881, Carlos Finlay, a Cuban physician, said he believed mosquitoes carried the disease. In 1900, a U.S. Army commission in Cuba proved that Finlay was right. Mosquito-control programs were then begun to wipe out the disease.

Under strong pressure from the Cuban people for immediate independence, the United States decided to let them govern themselves. In 1901, Cuba adopted a constitution. The constitution included a set of provisions, called the *Platt Amendment*, which the United States insisted must be part of the document. The amendment limited Cuban independence by permitting the United States to intervene in Cuban affairs. It also allowed the United States to buy or lease land for naval bases in Cuba. Under a treaty with Cuba in 1903, the United States received a permanent lease on Guantánamo Bay and began to build a large naval base there.

In 1902, the Cuban people elected Tomás Estrada Palma as the first president of the Republic of Cuba. American troops then left the country. But they returned in 1906, after opposition to Palma's government developed into open rebellion. A civil-military government, headed by Charles E. Magoon of the United States, ruled Cuba from 1906 to 1909.

The Second Republic of Cuba was established after American forces left the country in 1909. But the new Cuban government did little to help the lower classes. A Negro uprising broke out in 1912. In 1917, a workers' revolt threatened to destroy the sugar mills. American companies owned many mills, plantations, and other businesses in Cuba. During both uprisings, the United States sent military forces into the country to protect American property.

The Cuban people elected Gerardo Machado president in 1924. During his campaign, Machado had attacked the Platt Amendment and had promised reforms. But after becoming president, he ruled as a dictator. In July, 1933, an army revolt forced Machado out of office. Two months later, an army sergeant named Fulgencio Batista and a group of university students and professors led a revolution that overthrew the new government. They named a five-man committee,

IMPORTANT DATES IN CUBA

1492 Christopher Columbus landed in Cuba and claimed the island for Spain.

1517 The first African slaves arrived in Cuba.

1868-1878 Cuban revolutionaries fought Spanish rule in the Ten Years' War. Under the Pact of Zanjón, which ended the war, Spain promised reforms.

1886 Slavery was abolished in Cuba.

1895 A revolution, led by José Martí, broke out in Cuba against Spanish rule.

1898 The United States defeated Spain in the Spanish-American War. Spain gave up all claims to Cuba.

1898-1902 A U.S. military government ruled Cuba.

1902 Tomás Estrada Palma became the first president of the Republic of Cuba.

1906-1909 American forces occupied Cuba for the second time, after opposition to Palma's government grew into open rebellion.

1933 A revolutionary group, led by Fulgencio Batista, took control of the government.

1934-1959 Batista controlled the government, except for the years 1944 to 1952.

1953 Fidel Castro led an unsuccessful attack on the Moncada Army Barracks in Santiago de Cuba.

1959 Castro's forces overthrew Batista's government.

1961 Cuban exiles invaded Cuba at the Bay of Pigs and were quickly defeated by Castro's army.

1962 Russia agreed to U.S. demands that it remove its missiles and missile bases from Cuba.

1964 All members of the Organization of American States (OAS) except Mexico broke diplomatic and economic ties with Cuba.

1971 President Richard M. Nixon of the United States announced that Russia had agreed not to establish a permanent submarine base in Cuba.

United Press Int.

Fulgencio Batista, famous for his fiery speechmaking, ruled Cuba as dictator from 1934 to 1944 and from 1952 to 1959.

headed by Ramón Grau San Martín, to govern Cuba.

The Grau San Martín government wanted to reduce U.S. influence in Cuba and make far-reaching changes. The United States thought the new government was too extreme and refused to support it.

The Batista Era. Batista felt that his best hope for power lay in winning U.S. support. He removed Grau San Martín from office in 1934. Until 1940, Batista ruled Cuba as dictator through presidents who served in name only. The United States supported Batista's government. In 1934, the United States and Cuba signed a treaty that canceled the Platt Amendment, except for the Guantánamo Bay lease.

In 1940, Cubans adopted a new constitution and elected Batista president. The constitution prevented Batista from seeking re-election in 1944, and Grau San Martín became president again. Carlos Prío Socarrás won the 1948 election.

In 1952, Batista overthrew Prío's government and again became dictator. Cuba grew prosperous under Batista. He stressed the development of light industry and encouraged foreign companies to build businesses in Cuba. Batista also established badly needed public works. But most Cubans continued to live in poverty.

The Castro Revolution. On July 26, 1953, Fidel Castro, a young lawyer, tried to start a revolution against Batista by attacking the Moncada Army Barracks in Santiago de Cuba. Castro and many of his followers were captured and imprisoned. After his release in 1955, Castro went to Mexico. There, he organized the *26th of July Movement*, a revolutionary group named after the date of his first revolt. Castro's forces landed in Cuba in December, 1956. Most of the rebels were soon killed. But Castro and 11 others escaped to the Sierra Maestra mountains. There, they formed a guerrilla band to carry out surprise attacks against the Cuban government.

In 1957, Castro's forces began to attack army units and to blow up bridges and railroad tracks. Attempts by the government to crush the revolution increased the people's support of the rebels. By mid-1958, Cubans had lost confidence in Batista's government. On Jan. 1, 1959, Batista fled the country. Castro's forces then took control of the government. Later, Castro became premier of Cuba. Manuel Urrutia was named president. The revolutionary leaders did away with the political and military structure of Batista's government. Many former political officials and army officers were tried and executed.

Relations with the United States. At first, the United States supported the Castro government. But the leading revolutionaries did not welcome U.S. support. In 1959 and 1960, the Cuban government seized American-owned sugar estates and cattle ranches, and relations between the two countries declined sharply.

Immediately after the revolution, many Cubans who opposed Castro left the country. Most of them moved to the United States. In late 1959, a group of these exiles hired American planes and flew over Cuba, dropping anti-Castro leaflets and small fire bombs. Cuban leaders criticized the United States for not stopping the flights. The Castro government grew more hostile

Wide World

Castro Rode into Havana on a Tank after leading a successful revolution against the dictator Batista in 1959. Castro, *second from right,* quickly turned Cuba into a Communist state.

toward the United States after Western European nations, under U.S. pressure, refused to sell arms to Cuba. Cuba then turned to Russia for economic and military assistance. The two countries signed their first trade agreement in February, 1960.

In June, 1960, the Castro government took over American oil refineries in Cuba. The United States then stopped buying Cuban sugar. Castro responded by taking over all remaining American businesses in Cuba. In January, 1961, the United States ended diplomatic relations with Cuba.

The Bay of Pigs Invasion. In April, 1961, Cuban exiles invaded Cuba at the Bay of Pigs on the south coast. They had been promised direct U.S. military action, including air cover, to insure the success of the invasion. President John F. Kennedy had approved the invasion, but he refused to send military aid. Castro's forces crushed the invasion and captured most of the exiles. His government later released many of the exiles to the United States in exchange for nonmilitary supplies.

The Cuban Missile Crisis. In 1962, Cuban leaders became convinced that the United States was planning an attack on Cuba. They asked Russia for more military aid. Russia responded by sending missiles and materials to build launch sites. In October, the United States learned that Cuba had missile bases which could launch nuclear attacks on American cities. President Kennedy ordered a naval blockade to halt the further shipment of arms and demanded that Russia remove all missiles and missile bases from the island. For several days, the world stood on the brink of nuclear war. Finally, Russia agreed to Kennedy's demands in return for a U.S. pledge not to attack Cuba. Russia removed the weapons under protest from Castro.

Cuba Today is struggling to remain independent of Russia. Soviet aid has risen steadily since 1960. In 1970, Cuba received $460 million in aid and trade from Russia. But Castro does not want Cuba to become a Russian satellite. He has removed many Communists from their posts because they tried to model Cuba after Communist countries of Eastern Europe.

Castro has tried to spread revolution throughout Latin America and has supplied military aid to guerrilla groups in several Latin-American countries. But the guerrillas have not been successful. Ché Guevara, a leader in the Castro revolution, was killed during a guerrilla operation in Bolivia in 1967. Since then, the government has reduced its aid to revolutionary groups.

Cuba's relations with other Latin-American countries became strained during the 1960's. In January, 1962, the Organization of American States (OAS) excluded the Communist government of Cuba from active membership, though Cuba itself remained an OAS member. During the missile crisis, the OAS supported the U.S. naval blockade of Cuba. In 1964, the OAS criticized Cuba for sending military supplies to revolutionaries in Venezuela. All OAS nations except Mexico broke diplomatic and economic ties with Cuba. But by 1970, relations between Cuba and other Latin-American countries began to improve. During the early 1970's, several Latin-American nations re-established diplomatic ties with Cuba.

The Cuban government resents the presence of a United States naval base at Guantánamo Bay. Cuban leaders claim that the base threatens Cuba's security. But the United States refuses to give up Guantánamo. In 1964, Castro shut off the base's fresh-water supply. The United States then moved a plant that turns ocean water into fresh water to Guantánamo.

In October, 1970, U.S. officials charged that Russia was building a submarine base in Cuba that could endanger American security. Russia denied the charge, and U.S. officials offered little proof to support their claim. In January, 1971, President Richard M. Nixon announced that Russia had agreed not to establish a permanent base in Cuba.

ROBERT FREEMAN SMITH

CUBA / *Study Aids*

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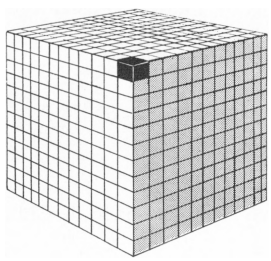
Questions

What was the Platt Amendment?
What are the two major goals of the Cuban government?
What are Cuba's two most important crops?
What was the 26th of July Movement?
How has the Cuban government promoted adult education?
What are *state farms?*
What was the Cuban missile crisis?
Why does Cuba have a mild climate the year around?
What are *asambleas?*
Why has Cuba's economy developed slowly under Fidel Castro's government?

CUBBERLEY, ELLWOOD PATTERSON (1868-1941), an American educator, helped develop the profession of school administration in the United States. He served as professor of education at Stanford University from 1898 to 1917, and as dean of the school of education from 1917 to 1933. Cubberley also wrote many books on education. He was born at Andrews, Ind., and studied at Indiana and Columbia universities. Before going to Stanford, he served as superintendent of schools in San Diego, Calif. GALEN SAYLOR

CUBE, in geometry, is a solid bounded by six equal squares, such as a child's alphabetical block. All the edges that make up the length, width, and depth of a cube are equal to each other. The *volume* of a cube, or the space it fills, is expressed in cubic inches, cubic feet, cubic centimeters, or some other cubic unit. The volume is found by multiplying the number that represents the length of one of the edges by itself, then multiplying by the length again. For example, if the edge of a cube is 4 meters, the volume of the cube is 4×4×4, or 64 cubic meters. In arithmetic, the *cube* of a number is the product obtained when a number is used as a factor three times. Thus, the cube of 4 is 4×4×4, or 64. This can be indicated by 4^3. See also CUBE ROOT; HEXAHEDRON; ROOT. HOWARD W. EVES



A Cube is bounded by six equal squares. Each face of a cube representing one cubic foot is 12 inches long and 12 inches wide. The volume is 12×12×12, or 1,728 cubic inches. The small black cube is $\frac{1}{12}$ of the length, breadth, and depth.

CUBE ROOT is one of three equal factors of a number (see FACTOR). The same number *(m)* taken as a factor three times will be the cube root of another number *(n)*. Thus, $m \times m \times m = n$. For example, 2 is the cube root of 8, because $2 \times 2 \times 2 = 8$, and -5 is the cube root of -125, because $-5 \times -5 \times -5 = -125$. A real number has only one real cube root, which is positive or negative, according to whether the given number is positive or negative. Another symbol is placed in front of a number to indicate that its root is to be *extracted*, or determined. This symbol is written $\sqrt{\ }$, and is called the *root sign*, or *radical sign*. If the root to be extracted is a cube root, a small figure 3 is placed above the root sign. Thus, $\sqrt[3]{8}$ indicates that the cube root of 8 is to be determined.

Finding Cube Roots by Tables. Perhaps the easiest way of finding cube roots is to use a *table of cube roots*, a *table of cubes*, or a *table of logarithms*. These tables provide correct answers and eliminate tedious calculations. In most cases, the numbers will not have exact cube roots. In these cases, tables are especially helpful.

Calculating Cube Roots. Sometimes tables may not be available. Or, if they are, they will not be accurate enough for a particular purpose. In this case, a person must make his own calculations.

One simple method can be used to calculate the cube root of a number between 1 and 1,000. For example, a person might wish to find the cube root of 200. Since $5 \times 5 \times 5 = 125$, and $6 \times 6 \times 6 = 216$, it is easy to see that 6 is the closest *integral*, or whole number, cube root of 200. A closer complete approximation can be made by dividing 200 by the square of 6, or 6×6, which equals 36. To the nearest tenth, this gives 5.6. Thus, $6 \times 6 \times 5.6$ is approximately 200.

To get the second approximation of the cube root of 200, average the three factors 6, 6, and 5.6. This will give $\frac{6+6+5.6}{3} = 5.9$. This procedure is repeated to obtain a still better approximation. Thus, $\frac{200}{5.9 \times 5.9} = \frac{200}{34.81} = 5.74$, and the next approximation is given by $\frac{5.9+5.9+5.74}{3} = 5.85$. Repeating once more gives $\frac{200}{5.85 \times 5.85} = \frac{200}{34.2225} = 5.8441$, which gives the next approximation $\frac{5.85+5.85+5.8441}{3} = 5.8480$.

This process may be continued indefinitely. In each approximation beyond the second, you can retain a number of digits that is one less than twice the number of digits found in the previous approximation. For example, the second approximation, 5.9, contains two digits. The third approximation may retain three digits, and the fourth approximation may retain five digits.

If the number whose cube is desired is not between 1 and 1,000, either multiply or divide it successively by 1,000 to bring it within this range. The cube root of this number will lie between 1 and 10. After finding the cube root, either divide or multiply it successively by 10 as many times as necessary to give the cube root of the original number. HOWARD W. EVES

See also CUBE; LOGARITHMS; ROOT.

CUBEB, *KYOO beb*, is the dried, unripe berry of a climbing vine belonging to the pepper family. It grows in Pinang, Sumatra, New Guinea, and neighboring islands. It resembles black pepper. Cubebs are used as spices in Asia, and as medicine in Europe and America. Drugs prepared from cubebs are used as kidney stimulants, urinary antiseptics, and expectorants. Cubebs, in the form of cigarettes, were formerly used to treat hay fever, asthma, and pharyngitis.

Scientific Classification. The cubeb belongs to the family *Piperaceae*. It is classified as genus *Piper*, species *cubeba*. HAROLD NORMAN MOLDENKE

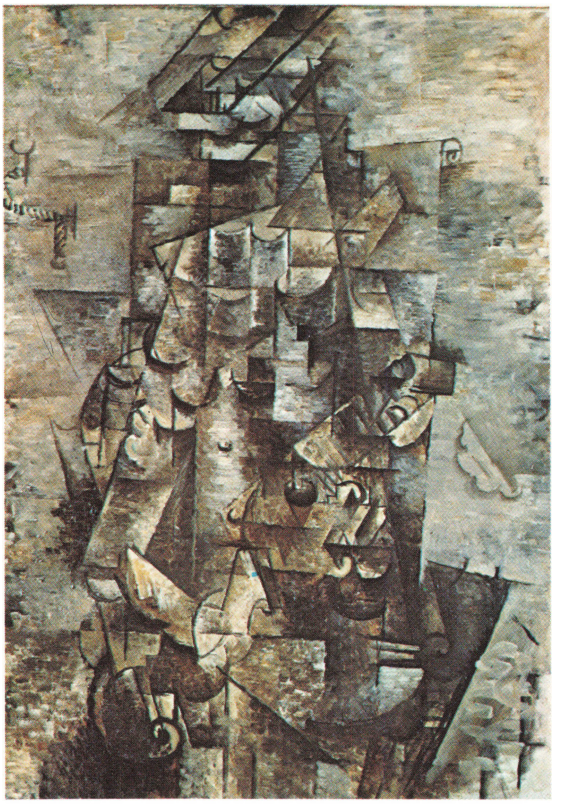
CUBIC MEASURE. See WEIGHTS AND MEASURES.

CUBISM was a movement in painting that sought to break down objects into the basic shapes of cubes, spheres, cylinders, and cones. Cubism developed in France in the early 1900's. Its emphasis on the relationships of pure shapes and lines had a great influence on all later art.

Pablo Picasso and Georges Braque led the Cubist movement. The Cubists were influenced by the strength and simplicity of African Negro sculpture and by the structural landscapes of Paul Cézanne (see CÉZANNE, PAUL). They became increasingly concerned with the problem of how to represent form in space. They developed a semigeometric method of analyzing objects into basic shapes. They would begin with a familiar object, such as a table or a guitar. Step by step, they would break it down, flatten it out, change its shapes and colors, and then reassemble it into planes.

Museum of Modern Art, New York, acquired through the Lillie P. Bliss Bequest

Early Cubism grew from Pablo Picasso's *Les Demoiselles d'Avignon*, of 1907, above. African Negro sculpture influenced it.



Museum of Modern Art, New York, acquired through the Lillie P. Bliss Bequest

Analytic Cubism divided objects into many fragments and planes, as in Georges Braque's *Man with a Guitar* of 1911, above.

The result was a new construction with only a trace of the original subject. The Cubists also introduced the dimension of time into painting by presenting various views of the object at the same time. Their experiments in this area were related to similar ones in the sciences.

Pablo Picasso's *Les Demoiselles d'Avignon*, painted in 1907, is considered the first Cubist painting. His later Cubist work *Mandolin and Guitar* appears in color in the PAINTING article. In addition to Picasso and Braque, important Cubist painters include Juan Gris (1887-1927) and Fernand Léger. PETER SELZ

See also BRAQUE, GEORGES; LÉGER, FERNAND; PAINTING (The 1900's); PICASSO, PABLO; GRIS, JUAN.

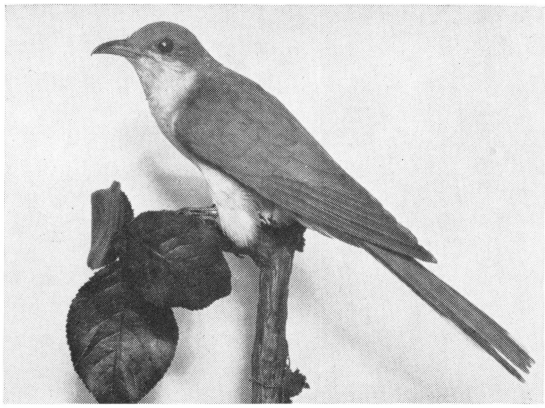
CUBIT, *KYOO biht*, is a measure of length used by several early civilizations. It was based on the length of the forearm from the tip of the middle finger to the elbow. No one knows when this measure was established. The length of the arm, or cubit, was commonly used by many early peoples, including the Babylonians, Egyptians, and Hebrews. The royal cubit of the ancient Egyptians was about 21 inches (53 centimeters) long. That of the ancient Romans was 17.5 inches (44.5 centimeters). The Hebrew cubit was 17.58 inches (44.7 centimeters). In the English system the cubit is 18 inches (46 centimeters). See also MEASUREMENT (Length and Distance). JOHN W. RENNER

CUCHULAINN, *koo KUHL ihn* (25 B.C.?-A.D. 2?), also spelled CUCHULLIN, is the hero of the *Tain Bo Cuailnge* (pronounced *thawn boh KOOL nyih*), or the *Cooley Cattle Raid*. This is Ireland's most famous tale of ancient times, as well as the oldest epic poem of Western Europe. It tells how Cuchulainn defended his kingdom of Ulster single-handedly against invaders. The story is based on fact, but the details are mythological. Cuchulainn's father was said to be Lug, the sun-god. The boy was called *Setanta* until he was 7 years old. Then he won the name of Cuchulainn, or *Hound of Culan*, by guarding the house of Culan, whose ferocious watchdog he had killed. After the young warrior had been wounded in battle, he tied himself to a pillar so that he might die on his feet. KNOX WILSON

CUCKOO, *KUK oo*, is the name of several beautiful closely related birds. The name *cuckoo* comes from the pleasant song of the European cuckoo. The two common kinds of cuckoos in North America are the *black-billed cuckoo* and the *yellow-billed cuckoo*. They are shy birds, but can be recognized by their call. Their song is a series of low, mournful, quivering notes. Both of these cuckoos are slender birds, about 1 foot (30 centimeters) long. Their tails are long and rounded. These cuckoos differ from most birds because two of the toes of their feet point forward and two backward. They have rather long and slightly curved beaks.

Both cuckoos have olive-brown backs and white breasts. The most important difference between the black-billed cuckoo and the yellow-billed cuckoo is the color of the bill. The black-billed cuckoo also has red circles around its eyes, and the yellow-billed cuckoo has larger white marks on its tail.

These cuckoos make their homes in woods, thickets, and orchards. They build untidy nests. There may be two to seven eggs in one nest. The eggs are green-blue with a dull surface. The American cuckoos have often been called *rain crows*. Many people think that frequent cuckoo calls mean that it is going to rain. The birds feed on insect pests such as hairy caterpillars that



Visual Education Service

A Black-Billed Cuckoo seems to like damp and cloudy weather. For this reason it is often called a *rain crow*, and many people believe frequent cuckoo calls mean that it is going to rain.

J. Horace McFarland

Cucumbers grow on long, trailing vines that are similar to melon vines. The vines bear yellow or whitish flowers on short stems. Cucumbers rank among the oldest known vegetables.

are shunned by other birds. Because they are insect-eaters, cuckoos migrate to the tropics during the winter.

The European cuckoo resembles a sharp-shinned hawk in size and color pattern, and has a sweeter song than the American cuckoo. It does not care for its own young. It lays its eggs in other birds' nests or carries them there in its bill, and leaves them to be hatched by the other bird.

Scientific Classification. The cuckoos belong to the cuckoo family, *Cuculidae*. The yellow-billed cuckoo is genus *Coccyzus*, species *C. americanus*. The black-billed is *C. erythrophthalmus*. The European cuckoo is classified as *Cuculus canorus*. ARTHUR A. ALLEN

See also BIRD (color pictures: Birds That Help Us [Yellow-Billed Cuckoo], Birds of Other Lands [Emerald Cuckoo], Birds' Eggs); ROAD RUNNER.

CUCUMBER is a common garden vegetable native to southern Asia, but cultivated as an annual in many parts of the world. The cucumber plant is a hairy-stemmed vine that bears many tendrils. Its triangular leaves may have three pointed lobes. It bears yellow or whitish flowers on short stems. Its edible fruit, commonly called *cucumber*, may grow from 1 to 36 inches (2.5 to 91 centimeters) long. The pulpy fruit contains many seeds and is covered by a thin, smooth or prickly skin. The flesh is usually white or yellowish.

Small cucumbers used for pickling are often called *gherkins*. But the true gherkin is another plant closely related to the cucumber. It bears many little spiny fruits shaped like olives.

People eat the young cucumber fruits raw or pickle them. The raw fruits are eaten in salads and sandwiches. The mature fruits are tough and contain many hard seeds. Such cucumbers are sometimes pickled or served as a hot vegetable. Cucumbers have little food value.

Cucumbers grow best in warm weather and are easily killed by frost. Gardeners grow them from seed. They sow the seed in small hills of loam or light soil as soon as warm weather comes. They build the hills about 4 feet (1.2 meters) apart to allow room for the vines to grow. When the plants start to grow, workers thin them so only four or five remain in a hill. The plants grow rapidly in warm weather and if they have enough moisture. Small fruits suitable for pickles appear quite soon. Gardeners pick them every two or three days.

Sometimes gardeners grow cucumbers in greenhouses. The plants grow much as they do in fields. But usually, because of the limited space, the gardener trains the vines on cords or wires. A cucumber plant frequently yields 100 or more fruits.

Several kinds of beetles attack young cucumber plants. Gardeners often spray the young plants with rotenone dust to destroy the insects. The *melon aphid* also attacks the cucumber plants and spreads *mosaic*, a virus disease.

Scientific Classification. The cucumber belongs to the gourd family, *Cucurbitaceae*. It is genus *Cucumis*, species *C. sativus*. Gherkins are *C. anguria*. JOHN H. MACGILLIVRAY

CUCUMBER TREE. See MAGNOLIA.

CUD is a small mass of food that animals called *ruminants* bring up from their stomachs for a second chewing. Ruminants include such animals as antelopes, camels, cattle, deer, and goats.

See also RUMINANT; CATTLE (Stomach).

CUDAHY, *KUHD uh hih*, **MICHAEL** (1841-1910), an American meat packer, developed and introduced cold-storage facilities in packing plants. This made possible year-round meat curing and livestock marketing. Cudahy went to work for a meat packer in Milwaukee, Wis., at the age of 14.

In 1875, he became a partner in Armour and Company. With P. D. Armour, he formed the Armour-Cudahy Company in 1887. Three years later, he established the Cudahy Packing Company, one of the largest in the United States, in Omaha, Nebr. Cudahy was born in Callan, Ireland, and came to the United States with his parents in 1849. JOHN B. MCFERRIN

CUE. See BILLIARDS; SHUFFLEBOARD.

CUENCA, *KWAYNG kah* (pop. 79,140), is a city in the Andes Mountains of southern Ecuador. For Cuenca's location, see ECUADOR (political map). Cuenca, a commercial center, leads Ecuador in the production of Panama hats. Other important products include cinchona bark, which is used to make drugs; gold; hides of alligators and other animals; and tires. The city has a modern cathedral and a picturesque market where Indians of the region sell their goods. Spaniards founded Cuenca in 1557. MURDO J. MACLEOD

CUERNAVACA, *KWEHR nah VAH kah* (pop. 134,117), is the capital of the state of Morelos in Mexico. It lies about 37 miles (60 kilometers) south of Mexico City (see MEXICO [political map]). The city's mild climate and beautiful scenery have made it a popular resort. The city has many beautiful estates and ancient buildings. Tourist attractions include the Palace of Cortes and the Borda gardens. The Spaniards founded the city in 1521. JOHN A. CROW

CUESTA. See HOGBACK.

CUFFE, PAUL (1759-1817), an American seaman and merchant, encouraged the colonizing of Negroes in Sierra Leone, Africa. He financed the voyage of 38 free Negroes in 1815. He also sought to strengthen the legal position of Negroes in America. His efforts led to a law, passed in 1783, which gave Negroes in Massachusetts the right to vote. Cuffe, part Negro and part Indian, was born on Cuttyhunk Island, Mass. He also became a minister among the Quakers. LOUIS FILLER

CUGNOT, NICOLAS JOSEPH. See AUTOMOBILE (The Steam Car; illustration).

CUISENAIRE METHOD, *KWIHZ uh NAIR,* is a teaching system designed to help students discover basic mathematical principles by themselves. The method uses rods of 10 different colors and lengths that can easily be handled by children. By using the rods, students can prove numerical relationships and understand principles of proportion. They can also learn addition, subtraction, multiplication, division, factors, and fractions.

The rods help the student understand mathematical principles rather than merely memorize them. For example, two white rods placed end to end are the same length as a red rod. The red rod then stands for the number 2 if the white rod represents 1. A red rod and a white rod placed end to end are as long as a light-green rod. The light-green rod then stands for 3, because it is as long as three white rods. The rods can also be used to represent different sets of numbers. For example, if the white rod is assigned a value of 3, the red rod becomes 6. If the red rod is given a value of 1, then the white rod becomes $\frac{1}{2}$.

Students can discover many facts about mathematical relationships by working with the rods. For example, three red rods placed end to end are as long as one dark-green rod. The dark-green rod is two-thirds as long as a blue rod. The student can see that the three red rods equal two-thirds of a blue rod. If the dark-green rod has a value of 12, then the student learns that 3×4 equals 12. He can also conclude that 12 is $\frac{2}{3}$ of 18.

Schoolteachers use the Cuisenaire Method in the United States, Canada, and parts of Europe. Georges Cuisenaire, a school teacher from Thuin, Belgium, developed the method. LOLA J. MAY

CULEBRA CUT. See PANAMA CANAL (Gaillard Cut).

CULEX. See MALARIA (Malaria in Animals); MOSQUITO (pictures).

CULIACÁN. See SINALOA.

CULLEN, COUNTEE (1903-1946), was a Negro poet known for his lyrical poetry on Negro themes. He established his reputation with his first published collection, *Color* (1925). His other early collections include *Copper Sun* (1927) and *The Ballad of a Brown Girl* (1927). He collected the poems by which he wished to be remembered in *On These I Stand,* published in 1947. Cullen wrote one novel, *One Way to Heaven* (1932), a portrait of life in Harlem. He and Arna Bontemps wrote the musical play *St. Louis Woman* (1946).

Cullen was born in New York City. He graduated from New York University in 1925, and earned an M.A. in English literature from Harvard in 1926. He received a Guggenheim fellowship to study in Europe, and spent much of his later life teaching. DEAN DONER

CULLINAN STONE. See DIAMOND (Famous Diamonds; picture).

CULLODEN MOOR. See SCOTLAND (Union with England).

CULPEPPER FLAG. See FLAG (picture: Flags in American History [Southern Flags]).

CULTIVATOR. See FARM AND FARMING (Terms); GARDENING (picture).

CULTURAL DEPRIVATION describes a condition in which a person lacks the skills needed to adjust successfully to life in our rapidly changing society. A child's home training may fail to give him the basic intellectual, emotional, and social skills needed to adapt to formal schooling. For example, his vocabulary may be so limited that he is unable to understand his teacher. He will do poorly in school, and his inadequate education will probably reduce his later earning ability.

Most culturally deprived children become culturally deprived, low-income adults. Social scientists conclude that cultural deprivation is responsible for the rise in the number of low-income families.

About one out of nine families in the United States has an annual income below the poverty levels established by the federal government. In about two-fifths of these families, the principal wage earner did not finish high school. In central cities, about one child in five comes from a low-income family.

Several local, state, and federal programs are designed to aid culturally deprived persons by bettering their educational and financial opportunities. The Head Start program prepares preschool children for formal education. See POVERTY (Measures to Eliminate Poverty); HEAD START.

Other terms used to describe culturally deprived persons include *educationally deprived, lower class,* and *underprivileged.* D. KEITH OSBORN

See also ECONOMIC OPPORTUNITY, OFFICE OF.

CULTURAL LAG is a theory that describes how and why culture changes. According to this theory, social change starts with the invention of new technology, but the ideas of people tend to delay the use of the invention and to interfere with its most efficient application. For example, the invention of the automobile created antagonism on the part of people who understood horses but could not understand this new mechanical device. Their ideas *lagged* behind the invention.

An American sociologist, William F. Ogburn, introduced this theory in the 1920's. He claimed that cultural lag is practically a universal process. Critics of the theory point out that, although this theory might explain some cultural change, not all social change follows this pattern. They maintain that ideas sometimes lead the way to important social changes without involving material inventions, as in many of the cultural changes of the Renaissance. JOHN F. CUBER

See also CULTURE (How Cultures Grow and Change).

CULTURE

CULTURE. We often use the word *cultured* to describe a person who appreciates good paintings, literature, or music. But, in the social sciences, culture has a different meaning. In the broadest sense, it refers to all distinctively human activities, and includes achievements in every field, which man passes on from one generation to the next. Culture means such activities as using a language, getting married, bringing up children, earning a living, running a government, fighting a war, and taking part in religious ceremonies. In a narrower sense, we refer to a culture as the sum total of the ways of life of a group of people. We may speak of Eskimo culture, Hottentot culture, or our own Western culture.

Some cultures belong to large groups of people, and others to small tribes. No two cultures are exactly alike. Simple cultures are usually the product of people who have no written language (see PRIMITIVE MAN). More complex cultures develop into civilizations (see CIVILIZATION).

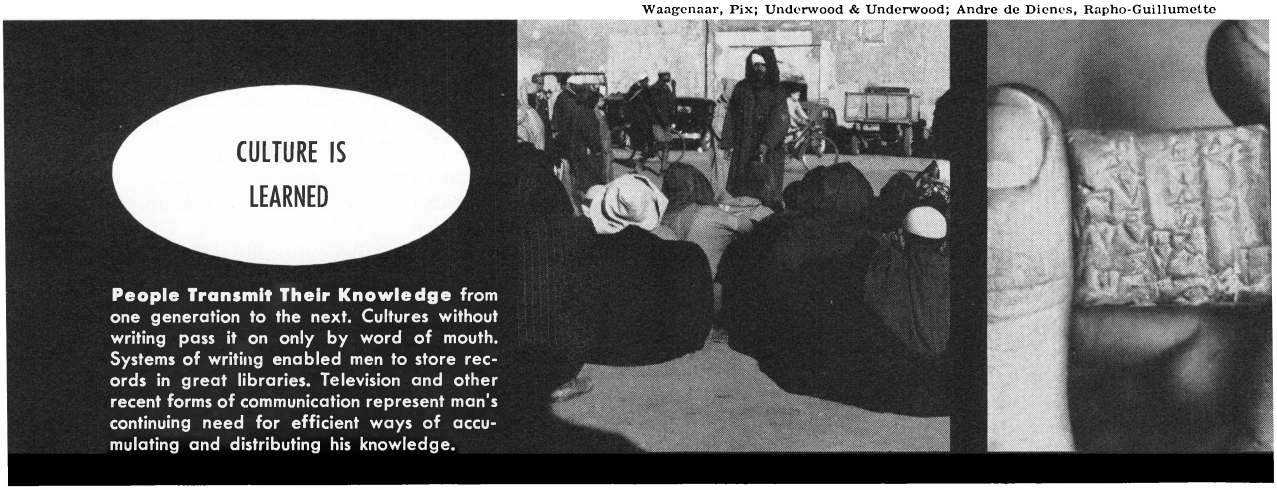
Scientists who study the cultures of peoples living in the past and present are called *anthropologists*. Social scientists called *sociologists* specialize in the study of our present-day culture. See ANTHROPOLOGY; SOCIOLOGY.

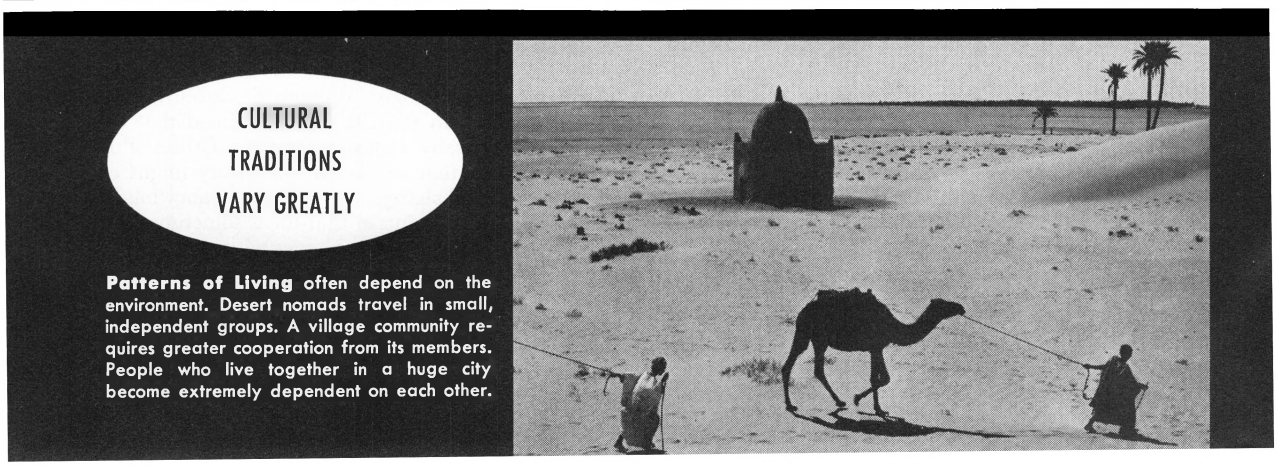
Scientists believe that the ability to develop culture is one of the greatest differences between men and animals. Culture must be learned, and men can learn so much more than animals that they can store up knowledge by means of speech and writing. Through many generations, man has acquired more and more knowledge, and cultures have grown and changed. But animals continue to live as they have always lived, because they cannot pass on their knowledge. Animal life may change gradually over hundreds of thousands of years, but such changes involve heredity more than learning. *Social animals*, such as ants, bees, and other insects, live in highly organized communities. But these societies seem to depend mainly on heredity. Each ant colony or beehive resembles every other colony or hive. For a discussion of the differences between men and animals that make culture possible, see MAN.

We can break down each culture into a number of *traits*. In Western culture, a man is allowed to be married to only one wife at a time. In the Arab culture, he may have four wives. *Monogamy*, or single marriage, is a trait in Western culture. *Polygyny*, or marriage to several women at once, is a trait of Arab culture. Several traits of a culture may be closely related. For example, tribes in eastern Africa keep cattle, live on milk products, use cow dung to plaster their houses, and wear cowhide garments. They consider cattle as wealth, and use them to buy wives. Such a group of related traits is called a *culture complex*. Many cultures that are different in other ways may share the same complex. The area in which this situation occurs is known as a *culture area*. For examples of culture areas, see INDIAN, AMERICAN (Major Culture Areas).

Various cultures stress different traits. Important traits that seem to guide other traits are called *key traits*. Prestige through wealth in cattle, as among the East Africans, is a key trait. It influences the people's food, clothing, shelter, and economic system. A great interest in life after death, which characterized the

Waagenaar, Pix; Underwood & Underwood; Andre de Dienes, Rapho-Guillumette





ancient Egyptians, is another key trait. Throughout their lives, the Egyptians prepared for death. Large numbers of people spent all their time building and decorating tombs, and creating objects to be placed in them. The culture of the North American Plains Indians emphasized accumulating honors for bravery in warfare, while Indians of the northwest coast acquired rank through wealth. A combination of key traits is known as a *system of values*, or a *culture pattern*.

The study of various cultures is important in giving us an understanding of our own behavior. It also helps us understand how to get along with the different groups of people living in the world.

How Cultures Are Alike

All cultures have certain things in common. These may deal with the *material* aspects of life, such as shelter. Or they may involve such *nonmaterial* activities as maintaining a government or creating myths. Elements common to all cultures include (1) technology, (2) institutions, (3) language, and (4) the arts.

Technology, as anthropologists use the term, includes what might be called the basic equipment for everyday living, and the way people use it. Man has no claws or fangs to catch animals for food, so he had to develop tools. All human cultures include the use of tools. Scientists have never found a group of people who lacked tools. Machines, which are complex tools, serve an extremely important function in our lives. But people of almost every culture use simple machines to make their work easier. See TOOL; MACHINE.

Another element found in all cultures is fire. All men use it to cook food and for keeping warm. But not every group knows how to make fire. In a few cultures, people have inherited it from their ancestors. Each family always tries to keep a fire burning. If it goes out, they borrow some live coals from neighbors. See FIRE.

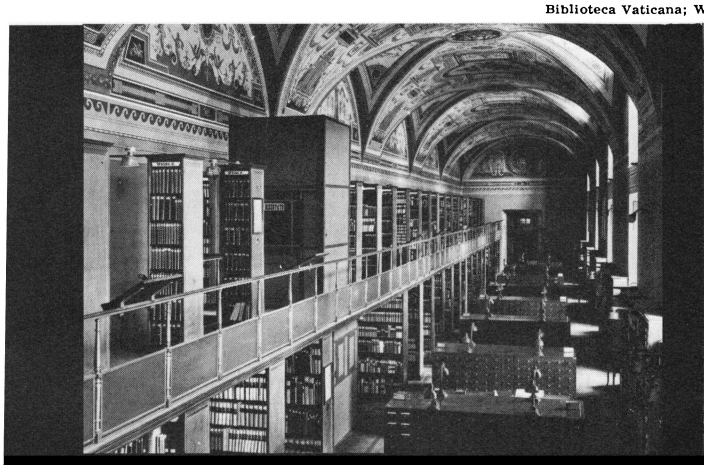
Everyone needs food, and most people prepare it in some way for eating. Most peoples either wear clothing or decorate their bodies with grease, clay, or earth pigments. Nearly everyone makes some kind of shelter, at least during seasons of cold or rain. But different cultures meet these needs in different ways. See FOOD; CLOTHING; SHELTER.

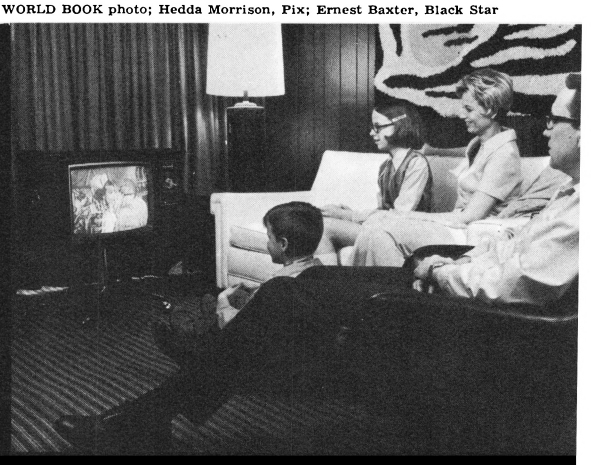
Institutions. An institution is a group of people who either live together or meet regularly for some purpose. The group controls the behavior of its members through a system of organization. Usually, some persons lead and others follow. Who leads and who follows depends on differences in sex, age, and individual qualities. A culture usually has several kinds of institutions. These may include the family; political, economic, and religious institutions; and voluntary associations.

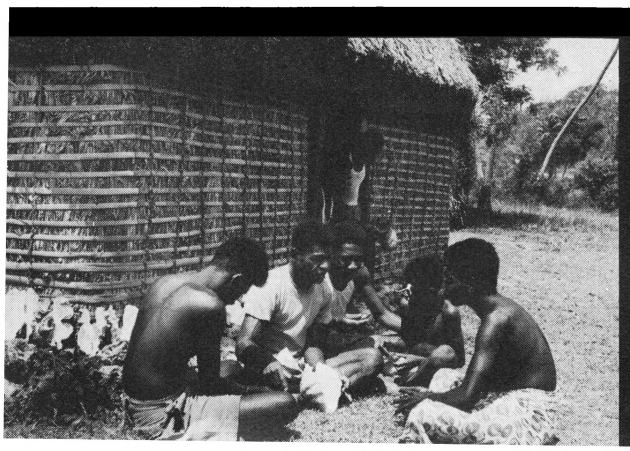
In all cultures, men, women, and children live together in families. The *family* is the one basic institution found everywhere. In simple cultures, the family educates the children. Advanced cultures have special education systems. See FAMILY; EDUCATION.

In the simplest cultures, the only institution larger than the family is the band, a group of families that live and collect food together. Many Indian tribes lived in bands. The members of each band form a kind of inde-

Biblioteca Vaticana; WORLD BOOK photo; Hedda Morrison, Pix; Ernest Baxter, Black Star







Chicago Sun-Times
American Woman

EVERYDAY CUSTOMS ARE PART OF CULTURE

Fashions in Clothing may indicate important cultural differences. The styles shown vary from casualness to great formality. They represent various religious beliefs, standards of beauty, and attitudes toward women.

Constance Stuart, Black Star
African Girl

Nator, Black Star
Japanese Dancer

Arab Woman

Emil Brunner, Pix

pendent nation, although it may have only a few dozen citizens. As cultures become more complex, greater numbers of people gather together to live and work. The nation may then have a chief or king, soldiers, tax collectors, messengers, or governors of provinces. Any such system of governing men, simple or complex, is called a *political institution*. There are many different systems of government, but the structures of most are basically the same. See GOVERNMENT; LAW.

Complex cultures, particularly those whose people grow food instead of hunting and collecting, usually have a division of labor. For example, one man may be an expert toolmaker. He makes tools for others, and they give him food in return. The toolmaker needs apprentices to help him and to learn his trade. The toolmaker and his apprentices, with their clients, form an *economic institution*. Economic institutions arise from both manufacturing and trade. In our own culture, a factory represents the former, a department store the latter. See ECONOMICS.

All cultures have some sort of *religious institutions*. In simple cultures, the band of related families can be its own religious unit. In complex cultures, there are separate religious institutions.

Anthropologists believe that many religious practices, especially in primitive cultures, grow out of the need people feel for comfort and reassurance. In farming regions, for example, the rain may sometimes fail just when it is needed to make the crops grow. This is an anxious time for everyone. A religious ceremony, such as the snake dance of the Hopi Indians of Arizona, may relieve the people's tension. While there is much more to religion than this, the need for relief from disturbance has often brought people together in religious congregations with leaders and followers.

Among most peoples, religion includes special songs, dances, costumes, and rituals. In probably all cultures, people believe that the spirit lives on in some form after death. Many persons in primitive cultures believe that spirits reappear from time to time, often in dreams. They believe that some individuals can communicate with the spirits (see MAGIC). These spirits often become gods. The gods are usually associated with things that disturb people, such as war, thunder, and love. In cultures with a division of labor, members of each trade or occupation may have a special god. Many anthropologists believe that the concept of a single god, governing all nature and all people, arises only in the most complex cultures. See RELIGION.

A fifth kind of institution is the *voluntary association*. It is composed of persons who come together of their own will through some common interest. Voluntary associations include such organizations as the Boy Scouts, college fraternities and sororities, and Indian secret societies. In some of the most complex societies, like our own, there are a great number of voluntary associations. They form a vital part of the web of relationships that holds our culture together.

Language. A third ingredient that all cultures have in common is the use of language. Each language provides a system of communication for the culture of which it is a part. But each language also provides for growth. It may reflect culture changes by adding new words and dropping old ones. Its grammar may become simplified in order to allow for easier change. English, for example, has a large vocabulary but a simple grammar.

Every language has three definite parts: sounds, vocabulary, and grammar. Each language uses only a small number of all the possible *sounds*. Some of these sounds differ from those of other languages. That is why persons who learn English after they grow up may pronounce certain sounds peculiarly. A language also has its own *vocabulary* that serves the needs of the people who speak it. For example, Arabs have more than five hundred words for different kinds of camels, and Eskimos have many words for kinds or conditions of snow. The Arabs use a single word for both snow and ice, and Eskimos have no word at all for camel. Snow creates no problem for the Arabs, and Eskimos have never had anything to do with camels. We know about both snow and camels, but neither is vital to our culture, so we have only one word for each. All languages have rules of *grammar* for the arrangement of sounds into words, phrases, and sentences. Primitive peoples may not be

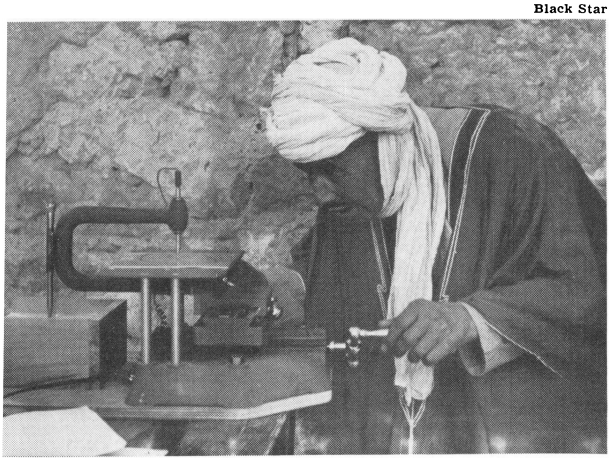
able to state rules of grammar, but they follow them nevertheless. See LANGUAGE.

The Arts. The desire for beauty seems to exist in every culture. The arts include myths and tales of ancient heroes, dancing, acting out legends and rituals, painting, sculpture, singing, instrumental music, and various combinations of these forms of expression. Like language, art serves basically as a means of communication. A clown can express strong emotions of sadness or joy with a single gesture. People tend to spend more time, energy, and skill on art than on any other activity. This is because communication holds together people who share a culture, and the arts are the most efficient form of communication. See ART AND THE ARTS.

Why Cultures Differ

The many cultures of mankind may resemble each other generally, but they differ greatly in details. We need only to glance through the pages of THE WORLD BOOK to find examples of ways of living that differ from our own. Some persons eat with knives and forks, some with chopsticks, and others with their fingers. The ancient Spartans punished children severely for misbehaving, but the Eskimos rarely touch a child in anger. Our culture believes in individual competition, but the Pueblo Indians feel it is wrong for one person to outdo his fellow men. Why do these differences exist?

Museum of the American Indian



Black Star

Cultures Borrow from Each Other. Sometimes people combine the borrowed elements with their own traditions to produce new traits. The peyote ritual of the North American Indians, shown *above* in a drawing by an Indian, mixes Christian customs with Indian rites. In other situations, especially those involving technology, people adopt new ways without much change. Such is the case with the Arab tribesman, *below*, operating a power tool.

One reason is that men differ greatly from each other physically. There is little difference between one earthworm and another, or between two robins of the same age and sex. But individual men and women differ greatly. The bodies of no two persons are exactly alike. The uniqueness of each human being makes life interesting, and allows cultures to change.

Men also behave differently from each other. Among animals, each animal behaves much the same as every other animal of the same kind. Even when animals of one species live on widely separated continents, they utter the same kinds of cries and calls, and build the same kinds of homes. Much animal behavior seems to be inherited. Animals have little to learn, and learn it quickly and simply. Humans have far more to learn, and learn it much more slowly. Each child must learn from his parents, brothers and sisters, playmates, and teachers, the thousands of details he needs in order to grow up in his own culture.

Men are hardy creatures, and settled long ago on every continent except Antarctica. They have lived for thousands of years in small groups, exposed to many different kinds of climate. Most of these groups have been separated from other groups and their cultures. Each group has worked out a way of living to suit its own particular conditions.

How Cultures Grow and Change

Some cultures appear to have gone on for thousands of years without change. This may be basically true, but details in such cultures have probably changed considerably. For example, hunters cannot usually change their basic culture if they live in an isolated area where food is scarce and there are no animals or plants to raise. Even a new method of hunting might kill off all the game, so there would be no point in using it. But changes would occur in fields unrelated to food-getting or to the social framework. The people might adopt new ways of decorating themselves, or of holding ceremonies, or of singing their songs.

A struggle goes on continually in every culture between the new ideas of some individuals and the forces of *conformity*, or the desire to do things in the same way everyone else does them. The *mores*, or fixed social and moral customs of a society, tend to enforce conformity (see MORES). Cultures need a certain amount of conformity in order to keep groups of people working together. But they also need new ideas to permit progress. A balance of these two forces keeps cultures strong and progressive.

Cultures grow and change in two main ways: (1) by invention and (2) by borrowing.

Invention is the only source of original cultural change. Inventions usually come from gifted persons who have keen powers of observation and the ability to link together in their minds the things they have

seen. Inventors also have the ability to imagine the results of their inventions. The man who invented the bow and arrow made hunting easier than it had been when the spear was the best weapon. The inventor of the sail improved navigation, and made it more efficient than when men used paddles and oars to travel in ships. But all inventions do not involve making new tools or machines. Many original ideas occur in the fields of social structure and religion.

People do not accept all inventions. They will reject a new invention, or use it as a toy, if it is not immediately useful. For example, the wheeled cart was invented in or near Mesopotamia around 3000 B.C. People soon used it to haul loads, because they had oxen to hitch to it. The Maya Indians of Central America also invented the wheel. But they used it as a toy, because they had no draft animals. A single device may be invented in several places at the same time or at different periods. Pottery and metalworking, for instance, were probably invented and put to use in both Asia and America. Even with present-day communications, several men may work completely independently of each other and arrive at the same conclusions. In this way, two mathematicians in different countries developed non-Euclidean geometry at almost exactly the same time. See INVENTION.

Borrowing, also known as *diffusion*, occurs more frequently than invention, because it requires less originality. The idea of the wheel probably originated in west-central Asia, and traveled throughout the world. Arabs carried the knowledge of fine steelmaking, developed in India, to Syria and Spain. From these countries, it spread to England and Germany. Diffusion may sometimes take place slowly, and in a roundabout way. For example, tobacco and tobacco-smoking originated in tropical America, and spread throughout the temperate regions of both North and South America. Early colonists carried the custom back to Europe. From there it traveled to Africa and Asia. Russians introduced the practice of smoking into Siberia, where the people developed a special kind of pipe with a flaring bowl. This form of pipe, as well as the knowledge of tobacco, traveled across Bering Strait and was adopted by the Eskimos. In this way, smoking traveled around the world before it reached a people who lived "next door" to its place of origin.

In our own culture, among other things, we have borrowed corn, beans, squash, potatoes, and tobacco from the American Indians. We learned from the Arabs how to use soap and the compass. Our knowledge of papermaking comes from the Chinese. Our seven-day week originated with the Babylonians, and our alphabet with the Phoenicians of western Asia.

When Cultures Meet

The people of one culture meet those of other cultures as groups grow. They usually exchange ideas and products. The impact of one culture on another is called *acculturation* (see ACCULTURATION). Such contact may be friendly or hostile. For example, when a band of New Guinea warriors attacks an enemy village by surprise, the victors may kill the men, and capture the women and children. If the captive women know some special skill, such as making shell beads, they may pass this trait on to the culture of their captors.

When people with a complex culture invade the territory of people with a simple culture, the earlier inhabitants often die out. This happens because the earlier people cannot withstand new diseases, or because they are pushed out of their hunting grounds. Even if they do not die out, their culture may disappear as the conquerors absorb them. Some cultures, such as the Tasmanian, have disappeared in this way. Others, including those of some Indians from eastern North America, survive only in a few tribal ceremonies.

When a strong people with a simple culture conquers a weaker but more civilized people, the victors may absorb much of the older culture. The ancient Romans conquered the Greeks, but the Greeks had a more advanced culture in arts and sciences, and became teachers of the Romans.

Cultures have blended because transportation and communication bring peoples together. For example, the Japanese have adopted such western institutions as steelmaking, deep-water shipping, railroads, newspapers, and parliamentary government. But they have kept many essentials of their own earlier culture, such as ways of eating and dressing, a love of ceremony, and elements of the samurai code and Shinto religion.

Theories About Culture

The concept of culture held by most anthropologists originated fairly recently. The first definition of culture as a sociological term was that of E. B. Tylor, a British anthropologist, who wrote in 1871: "Culture . . . is that complex whole which includes knowledge, belief, art, morals, custom, and any and all other capabilities and habits acquired by man as a member of society." In this definition, Tylor considered culture as the sum total of human achievements. In 1916, Clark Wissler, an American anthropologist, distinguished between culture in general and the separate cultures of individual groups of people. He also stated that culture has to be learned. During the 1920's, the functional anthropologists, headed by A. R. Radcliffe-Brown and Bronislaw Malinowski of Great Britain, emphasized the fact that each culture is an integrated whole, like a living being. Since that time, American anthropologists, including Alfred L. Kroeber, Ruth Benedict, and Clyde Kluckhohn, have developed two new fields of cultural research. Their studies have investigated (1) culture and the individual personality, and (2) the systems of values developed by various cultures. These two fields treat cultures as living and functioning wholes. Further work in analyzing cultures may perhaps bring culture closer to the biological basis on which it ultimately, though indirectly, depends.

CARLETON S. COON

Related Articles in WORLD BOOK include:

Acculturation	Ethnocentrism	Mores
Assimilation	Folklore	Prehistoric Man
Civilization	Folkway	Primitive Man
Community	Human Relations	Races of Man
Cultural Lag	Man	Segregation
Custom	Minority Group	Sociology

Outline

I. How Cultures Are Alike
A. Technology
B. Institutions
C. Language
D. The Arts

II. Why Cultures Differ
III. How Cultures Grow and Change
A. Invention
B. Borrowing
IV. When Cultures Meet
V. Theories About Culture

Questions

What basic elements do all cultures have in common?
Why do people sometimes reject a new invention?
What has our culture borrowed from other cultures?
How does a culture trait differ from a culture complex?
How do cultures change?
Why do cultures need both conformity and new ideas?
What is an example of an economic institution in our own culture?
Why do cultures differ so much in details?
Why do animals fail to develop a culture?
In what different ways can acculturation work?

CULTURE consists of microorganisms or tissue cells grown in the laboratory on a *culture medium* (material containing nutrients). Microorganisms grown in cultures include bacteria, yeasts, and viruses. A *pure* culture contains only one *species* (kind) of microorganism. A *mixed* or *contaminated* culture contains more than one kind. The kinds of nutrients required depend on the organism's needs. Common nutrients include carbohydrates, proteins, and minerals. They are usually dissolved in water. Solid medium may be made by adding agar or gelatin (see AGAR; GELATIN). MARTIN FROBISHER

CULVER-STOCKTON COLLEGE. See UNIVERSITIES AND COLLEGES (table).

CUM LAUDE. See DEGREE, COLLEGE.

CUMBERLAND. See ENGLAND (political map).

CUMBERLAND, Md. (pop. 29,724), ranks high among the cities of western Maryland in size and industrial importance. It lies at the picturesque "Narrows" where Wills Creek empties into the Potomac River (see MARYLAND [political map]).

Cumberland industries produce such diversified products as bakery goods, beer, brick, Celanese fibers, dairy products, electronics products, macaroni, microscopic drills, paper, plate glass, and steel shafting.

Cumberland has many historic homes and monuments. Fort Cumberland, built in 1754, served as a base for George Washington's expeditions before and during the French and Indian War. General Edward Braddock's march on Fort Duquesne started there, in 1755. Cumberland was the east end of the National Road. The first Baltimore and Ohio train entered the town in 1842. Cumberland, incorporated as a city in 1856, has a commission government. It is the seat of Allegany County. FRANCIS C. HABER

CUMBERLAND COLLEGE. See UNIVERSITIES AND COLLEGES (table).

CUMBERLAND GAP is a natural pass through the Appalachians, at the meeting point of Virginia, Kentucky, and Tennessee. Pioneers used the gap as a gateway to the West. Between 1775 and 1880, about 200,000 persons passed through the gap. The gap is 1,600 feet (488 meters) above sea level, cutting through the Cumberland Mountains. It is narrow, and has steep sides about 500 feet (150 meters) high. Railroads run through the gap. Laurel and rhododendron cover the area. The Cumberland Gap National Historical Park covers 20,176.49 acres (8,165.13 hectares) and is one of the country's largest historical parks.

Thomas Walker's exploring party used the gap in 1750, and in 1775 Daniel Boone blazed his "Wilderness Road" through the pass (see BOONE, DANIEL). Cumberland Gap was the route of Union armies invading Tennessee in 1862 and 1863. E. WILLARD MILLER

See also UNITED STATES, HISTORY OF (color picture: Americans Explored and Won); KENTUCKY (color picture); NATIONAL PARK SYSTEM (table).

CUMBERLAND MOUNTAINS, part of the Appalachian Mountain system, extend across part of eastern Tennessee and Kentucky, and form the boundary between Virginia and Kentucky. Some geographers call this mountain region the Cumberland Plateau. Streams have carved a complex pattern of narrow, steep-sided valleys into the mountains. The Cumberlands rise from 2,000 to 3,000 feet (610 to 910 meters) above sea level. The mountains contain rich coal fields. See also APPALACHIAN MOUNTAINS. E. WILLARD MILLER

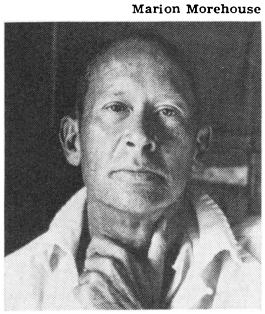
CUMBERLAND RIVER, an important branch of the Ohio River, rises in the Cumberland Mountains in eastern Kentucky. It empties into the Ohio River at Smithland, in northwestern Kentucky. The winding Cumberland is 720 miles (1,160 kilometers) long, and the river drains an area of about 18,000 square miles (46,600 square kilometers). The Cumberland drops 68 feet (21 meters) to make the Great Falls in Cumberland Falls State Park, Kentucky. It is navigable 461 miles (742 kilometers) upstream to Wolf Creek Dam. The principal cities on the river are Nashville and Clarksville, Tenn. See also OHIO RIVER. E. WILLARD MILLER

CUMBERLAND ROAD. See NATIONAL ROAD.

CUMMINGS, E. E. (1894-1962), was an American poet and playwright. Seeking a spontaneous and fresh presentation, he generally disregarded the rules of grammar and punctuation. He frequently coined his own words and compounds, and ran words and sentences together. He often abandoned the use of capital letters and spelled his name e e cummings. Beneath the deceptively complex surface, however, his poems offer a relatively simple point of view.

Cummings was always concerned with preserving individuality in an age he felt was dominated by Communism and American materialism. He denounced Russia's "apotheosis of mediocrity" and called the United States "a pseudocommunity enslaved by perpetual obscenities of mental concupiscence." His verse plays *Him* (1927) and *Santa Claus* (1946), as well as much of his lyric poetry, defend individualism and offer sentimental and romantic justifications of love, feeling, and intuition as opposed to science and systematic knowledge.

e e cummings
Marion Morehouse



Edward Estlin Cummings was born in Cambridge, Mass., the son of a prominent Boston clergyman. Cummings volunteered as an ambulance driver in World War I, and vividly described his experiences in a detention camp in his first book, *The Enormous Room* (1922). He returned to Paris in 1921,

and published the poems that won him a reputation as a radical experimenter. His *Complete Poems, 1913-1962* was published in 1973. ELMER W. BORKLUND

CUMULUS. See CLOUD.

CUNARD, SIR SAMUEL (1787-1865), founded the Cunard line of steamships. In 1838 he and two Englishmen formed a company for mail service between England and America by steam rather than by sailing vessels. The *Britannia* made the company's first voyage in 1840. Cunard was made a baronet for services the Cunard lines rendered to Great Britain in the Crimean War. He was born in Halifax, N.S. W. H. BAUGHN

CUNAXA, BATTLE OF. See CYRUS THE YOUNGER.

CUNEIFORM, *kyoo NEE uh fawrm*, was a system of writing used long before modern alphabets were invented. The name comes from the Latin *cuneus*, meaning *wedge*. Cuneiform writing was so named because cuneiform strokes, made with a stylus, are broad at one end and pointed at the other, like a wedge.

Cuneiform writing is hard to translate because the characters may represent either a word or a syllable. One character may have several different meanings.

The most common material used for cuneiform writing was clay, molded into a square slab or tablet. Cuneiform characters were scratched on the tablets while the clay was still moist. Then the tablets were dried in the sun or baked in an oven until they hardened.

Its Beginnings. The Sumerian people were probably the inventors of cuneiform writing. They developed it from picture writing. The earliest known inscriptions are from the lower Tigris-Euphrates Valley in Mesopotamia, or Iraq. Tablets found in Uruk (Warka) and nearby sites may have been written as early as 3000 B.C. Many of the characters in these groups retain their picturelike forms, for the wedgelike type of writing did not develop until about 2500 B.C. The latest cuneiform clay tablet that has been discovered was written only a few years before the Christian Era began in A.D. 1.

The cuneiform writings of the Sumerians are not only the oldest, but also the most complicated. The Akkadian-Sumerian system had about 600 characters. The Hittites used about 350 characters, the Elamites about 200, and the Persians only 39. An alphabetic cuneiform script of only 30 symbols was recovered about 1929 from excavations in northern Syria.

Cuneiform Translation was not attempted until shortly before 1800. European travelers in western Iran then noticed the ancient inscriptions carved 300 feet (91 meters) above the ground on the steep side of Behistun Rock. In 1802, a German named Georg Grotefend began to translate these inscriptions. Several other scholars, notably an Englishman named Rawlinson, became interested, and by the mid-1800's the translation was complete. It turned out to be a record of the accomplishments of the Persian king Darius, written in three languages. This record proved to be the key to cuneiform writing in other languages.

Since 1802 several hundred thousand cuneiform tablets have been recovered and placed in museums. The information gained from them has shed new light on the early history of man. WILLIAM A. MCDONALD

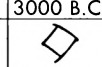
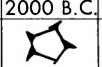
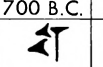
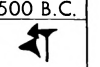
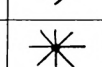
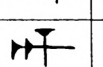
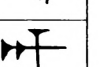
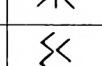
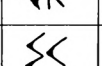
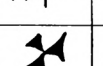
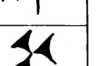
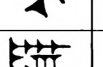
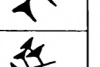
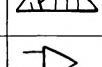
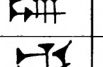
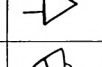
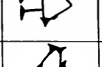
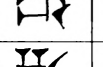
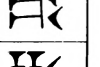
See also ALPHABET; ARCHAEOLOGY; DARIUS; COMMUNICATION.

CUNNINGHAM, ANN PAMELA (1816-1875), founded the Mount Vernon Ladies' Association of the Union in 1853 to make a national shrine of Mount Vernon, President George Washington's home (see MOUNT VERNON LADIES' ASSOCIATION OF THE UNION). In 1853, she visited Mount Vernon and was distressed to see the home going to ruin. She started her campaign in newspapers. In 1856, the state of Virginia granted a charter to the association. The association raised about $200,000 to buy the mansion and 202 acres (82 hectares) of land. On Feb. 22, 1859, the association bought the property. During the Civil War, Mount Vernon was neutral ground. After the war, Miss Cunningham moved in and took over direction of the estate. She was born in Laurens County, S.C. HELEN E. MARSHALL

CUNNINGHAM, GLENN. See TRACK AND FIELD.

CUNNINGHAM, MERCE (1919-), is an American dancer and *choreographer* (dance composer). Cunningham's dances do not have the usual elements of plot and character. He often creates dances without knowledge of the music that will accompany them. He became particularly known for his methods of *chance composition*. Often, in choreographing a dance, he would

Examples of Cuneiform Writing

MEANING	Outline Character about 3000 B.C.	Cuneiform about 2000 B.C.	Assyrian about 700 B.C.	Babylonian about 500 B.C.
The Sun				
God or Heaven				
Mountain				
Man				
Ox				
Fish				

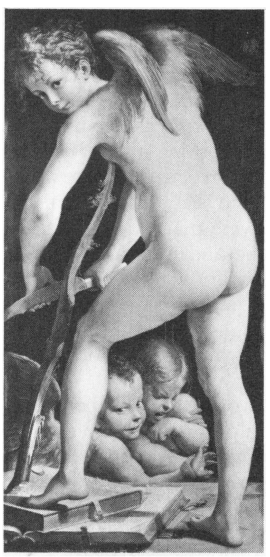
Merce Cunningham performed with Barbara Lloyd in his dance *Rain Forest*. Artist Andy Warhol designed the plastic pillows.

Transworld Feature Syndicate

write the name of a movement, the name of a dancer, a length of time, and a space on the stage. He would then toss dice or dip into a grab bag to determine who would do what movement for how long and where.

Cunningham was born in Centralia, Wash. From 1940 to 1945, he was a soloist with the Martha Graham company. In 1953, he formed his own group with experimental composer John Cage as musical director. Cunningham's major works include *Aeon* (1961), *Field Dances* (1963), *Winterbranch* (1964), and *Walkaround Time* (1968). SELMA JEANNE COHEN

CUPID was the Roman god of love. He is called Eros in Greek mythology.



Oil painting (early 1500's) by Parmigianino; Kunsthistorisches Museum, Vienna

Cupid, a winged boy, was the god of love in Roman mythology.

The ancient Greeks and Romans described Cupid as having both a cruel and a happy nature. Cupid's cruelty came forth in his treatment of his wife, the beautiful princess Psyche. Cupid forbade Psyche ever to try to see what he looked like. He refused to be with her except at night in the dark. One night while Cupid was asleep, Psyche lit a lamp so she could look at him. Cupid awoke and fled in anger. But myths also describe Cupid as a happy, handsome lad who united lovers whenever he could.

The earliest images of Cupid show him as a handsome, athletic young man. By the mid-300's B.C., he was portrayed as a chubby, naked infant with wings, holding a bow and arrows. A person shot with one of Cupid's arrows supposedly fell in love. C. SCOTT LITTLETON

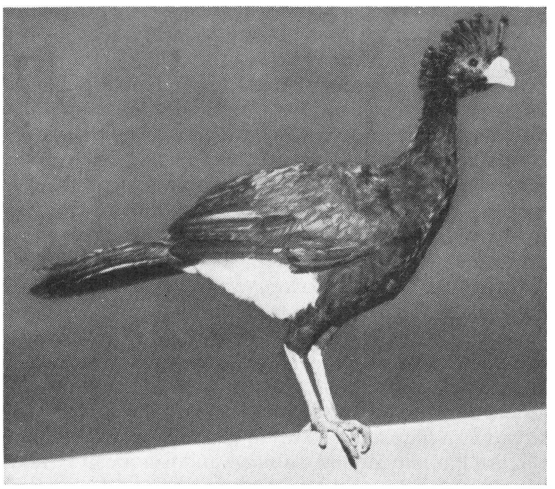
See also PSYCHE.

CUPOLA, *KYOO puh luh,* is a word that comes from the Latin and means a *little bowl* or *cup.* In architecture, it refers to a roof that resembles a bowl turned upside down. Some authorities use the terms *cupola* and *dome* to mean the same thing. Others apply the word *cupola* to small domes only. The inner vault of a large dome is called a cupola. See also DOME. KENNETH J. CONANT

CURAÇAO. See NETHERLANDS ANTILLES.

CURARE, *kyu RAH ree,* is a powerful poison. It is made from various poisonous plants, including several species of the *Strychnos* plant. It is sometimes called oorara, oorari, or urari. Curare is a black, thick syrup that soon turns into a hard, brittle mass. Several alkaloids found in curare, such as curarine, tubocurarine, and protocurarine, make it a strong poison.

South American tribes use curare as an arrow poison for hunting. It is a powerful poison only when injected into the blood stream or outer tissues of the body. It paralyzes many of the muscles of man and other mammals. Some of these muscles are used in breathing. A victim of curare poisoning usually dies of suffocation. Curare has been used in the treatment of tetanus and hydrophobia. It is also used during anesthesia to cause relaxation of the muscles. A. K. REYNOLDS



United Press Int.

The Crested Curassow is a South American game bird that looks like a barnyard fowl. Its flesh is good to eat.

CURASSOW, *KYUR uh soh,* is a large, handsome bird of tropical America. The *crested curassow* of northern South America looks something like a turkey. Its feathers are black, with a purplish-green gloss on the back and on the breast. It is white underneath. The long feathers of its crest can be raised forward or lowered as easily as wings. The curassow's bill is strong, and often has a raised knob on top. Curassows can be tamed, and their flesh is good to eat. They feed on nuts and fruits and range north to southeastern Mexico.

Scientific Classification. Curassows belong to the guan family, *Cracidae.* The crested curassow is genus *Crax,* species *C. alector.* JOSEPH J. HICKEY

CURB EXCHANGE. See STOCK EXCHANGE (History).

CURCULIO, *kur KYOO lee oh,* is any one of a large group of snout beetles. The curculios include some of the most destructive beetles that attack nut and fruit trees.

One of the most important curculios is the *plum curculio,* which feeds on plum, peach, apricot, cherry, and apple trees. It lives east of the Rocky Mountains in the United States. The plum curculio is a brownish beetle with gray and black markings. It is about $\frac{1}{4}$ inch (6.4 millimeters) long. It has a thick body and a long snout.

Scientific Classification. The curculios are in the snout beetle family, *Curculionidae.* The plum curculio is genus *Conotrachelus,* species *C. nenuphar.* R. E. BLACKWELDER

CURD. See CHEESE (How Cheese Is Made).

CURFEW is the time of day which once brought with it evening and the end of work. The word comes from the French expression *couvrefeu* which means *cover the fire.* At curfew time a bell was rung, the lights went out, and the fires were covered. Sometimes the bell itself was called a curfew. William the Conqueror introduced the custom of curfew in England during the Middle Ages. In 1103 Henry I repealed the law, but the bell continued to be rung. It may still be heard in parts of Great Britain.

In the United States, some communities have a curfew hour after which children are not allowed on the streets or in public places. The custom began long ago,

but in Omaha, Nebr., about 1880, a curfew law was passed. Children under 15 had to be indoors after 8 P.M. unless they were with an adult or had written permission from their parents or guardians to be away from home. Many U.S. cities passed similar curfew laws. Sometimes communities find curfew laws for adults necessary during time of war. Persons of an enemy nationality are often required to be in their homes after a certain hour in wartime. EMORY S. BOGARDUS

CURIA REGIS, *KYOOR ee uh REE jis*, was a group that helped kings govern during the Middle Ages. The group was often called the *King's Council* or *King's Court.* Its members consisted of leading barons, churchmen, and other officials. The court advised the king on important affairs of state, agreed to taxation and legislation, and served as a high court to settle difficult legal cases. The English Parliament and Cabinet, and European systems of administration and law, developed from it.

For normal government business, the king depended on his household officials and a few trusted barons and churchmen. This small group, also called *curia regis*, met daily. BRYCE LYON

CURIE, *KYOO ree*, is a unit used to measure radioactivity. Originally, it was the amount of radioactivity given off by 1 gram of radium. Today, the curie is defined as the quantity of any radioactive material that produces 3.7×10^{10} nuclear disintegrations a second. A *millicurie* is a thousandth of a curie.

CURIE, *kyoo REE*, is the name of a famous family of French physicists. They received three Nobel prizes for their work concerning radioactivity.

Pierre Curie (1859-1906), the son of a Paris physician, studied and taught physics at the Faculté des Sciences in Paris. While still in his 20's, he did important research on the magnetic properties of metals. The temperature at which these magnetic properties suddenly change is known today as "the Curie point." In 1880, with his brother Jacques, he discovered and studied the piezoelectric properties of crystals. Curie was born in Paris.

Marie Sklodowska Curie (1867-1934), the daughter of teachers in Poland, came to Paris to study physics and chemistry. She married Pierre Curie in 1895. The next year, Antoine Henri Becquerel discovered natural radioactivity (see BECQUEREL). The Curies became interested in the radiations given off by radioactive substances, and worked together in investigating them.

They discovered that uranium ore contained much more radioactivity than could be accounted for by the uranium itself, and set about searching for its source. From tons of the uranium ore, or pitchblende, they isolated small amounts of two highly radioactive new chemical elements, and named them *radium* and *polonium*. For this work they received, along with Becquerel, the 1903 Nobel prize for physics.

Pierre Curie received a professorship at the Sorbonne in Paris. After his death in 1906, Marie Curie was appointed to succeed him. In 1911, she received the Nobel prize for chemistry for her work on the isolation of radium and polonium, and for her investigations of their chemical properties.

Marie Curie was instrumental in founding the Radium Institute in Paris, and became its first director. During World War I, she took a mobile radiographic unit to the battlefront, where she was accompanied by her eldest daughter, 17-year-old Irène, who acted as a nurse. Marie Curie was born in Warsaw, Poland.

Irène Joliot-Curie (1897-1956), after World War I, came to the Radium Institute to serve as her mother's assistant in the laboratory. Also working in the Institute was Frédéric Joliot (1900-1958), a recent graduate of the Paris Institute for Industrial Physics and Chemistry. In 1926, he and Irène Curie were married. He was interested in fundamental atomic and nuclear processes. In 1933, he and his wife and Marie Curie investigated the formation of electrons and positrons by the passage of high-energy radiation through matter. They determined the conditions under which these formations could occur.

In 1934, the Joliot-Curies worked on the bombardment of various elements by alpha rays. They demonstrated that such a bombardment of boron created a radioactive isotope of nitrogen. This discovery paved the way for the production of artificial radioactive elements. Their work brought them the Nobel prize for chemistry in 1935.

Wide World

Irène Joliot-Curie

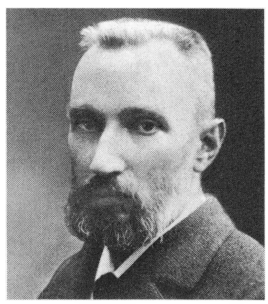
Joliot-Curie was active in the French resistance movement during the German occupation. He also continued his research, which contributed materially toward the achievement of the release of atomic energy. After the liberation of France, he was named head of the French Atomic Energy Commission. Irène became a member of the commission. Under the direction of this group, the French put an atomic pile into operation in 1948. The Joliot-Curies became outspoken Communists during the 1940's. Irène Joliot-Curie died in 1956 of leukemia, the same disease that had taken her mother's life.

Ève Curie (1904-), another daughter of Pierre and Marie Curie, did not inherit the scientific interest of her family. But she became well known as an author and lecturer. Her book *Madame Curie*, a biography of her mother, has been published in more than 20 languages. At the beginning of World War II, she became a coordinator of women's war activities in France. G. GAMOW

See also PITCHBLENDE; POLONIUM; RADIOACTIVITY; RADIUM; URANIUM.

Wide World

Marie Curie



United Press Int.

Pierre Curie

CURITIBA, *koo ree TEE buh* (pop. 497,626; met. area 767,879), is the capital of the state of Paraná in Brazil. It lies on a plateau, near the Iguaçu River in the center of a rich lumbering and coffee-growing area. For location, see Brazil (political map).

CURIUM, *KYOO ree uhm* (chemical symbol, Cm), is a man-made radioactive element. It has an atomic number of 96. Its most stable isotope has a mass number of 247. Curium was discovered in 1944 by three American scientists, Glenn T. Seaborg, Ralph A. James, and Albert Ghiorso. They produced curium by bombarding plutonium, element 94, with helium ions in the cyclotron at the University of California in Berkeley (see Ion and Ionization). Numerous isotopes of curium are produced by charged-particle bombardment of lighter transuranium elements (see Transuranium Elements). A process of neutron capture in these lighter elements produces weighable amounts of isotopes with mass numbers from 242 through 248. Curium is so radioactive that it glows in the dark. Glenn T. Seaborg

See also Element, Chemical (table); Radioactivity; Seaborg, Glenn Theodore.

CURLEW, *KUR lyoo,* is a long-legged bird that is related to sandpipers and snipes. It is found from Patagonia, in the far south of South America, to the Arctic region in North America. Curlews have long, slender bills which curve downward. They are wading birds, but they nest on dry ground, often far from water.

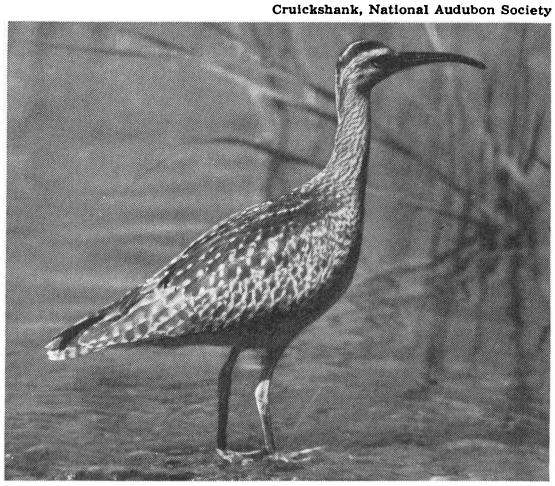
The *long-billed curlew* is one of the most common. It is 2 feet (61 centimeters) long and has a short, rounded tail. Its back is pale brown and spotted with black and dark-brown marks. The breast of the long-billed curlew is rusty brown and is more or less streaked. It has slender, bare legs. It gets its name from its slender bill, which is about 8 inches (20 centimeters) long. It uses its bill to catch small crabs, shellfish, snails, worms, grasshoppers, and beetles.

The *whimbrel,* or Hudsonian curlew, is a smaller member of the group. Commonly found on the eastern coast of North America, it migrates to South America in the winter. The rare *Eskimo curlew* is still smaller.

Scientific Classification. The curlew is in the sandpiper family, *Scolopacidae.* The long-billed curlew is genus *Numenius,* species *N. americanus.* The whimbrel is *N. phaeopus;* the Eskimo curlew is *N. borealis.* Alfred M. Bailey

The Whimbrel Is a Handsome Curlew.

Cruickshank, National Audubon Society



See also Sandpiper; Snipe.

CURLEY, JAMES MICHAEL (1874-1958), a colorful American politician, was best known as mayor of Boston. He also served as a Democratic state legislator, member of the U.S. House of Representatives, and governor of Massachusetts.

Curley served four terms as mayor of Boston (1914-1918, 1922-1926, 1930-1934, and 1946-1950). His methods and honesty were disputed, but he was popular among Boston's poor. When he was fined $30,000 in a fraud case in 1938, thousands of citizens donated money to pay the fine. Later, while serving as mayor in 1947, Curley went to prison after being convicted in a mail fraud case. He served five months. President Harry S. Truman issued him a full pardon in 1950. Curley was born in Boston. Charles Forcey and Linda Forcey

CURLING is a game played on a level sheet of ice. Two four-man *rinks* (teams) compete on a sheet of ice that is 146 feet (45 meters) long and 14 feet (4.3 meters) wide. The players slide heavy stones on the ice toward a round target. Curling probably began in Scotland and The Netherlands about 300 years ago. It has become popular in Canada and parts of the United States. A curling tournament is called a *bonspiel.*

The Game usually consists of 10 or 12 *ends.* Each player slides two stones toward the *house* (target), a 12-foot (3.7-meter) circle at the opposite end of the ice, alternating with his opponent from the other rink. When all 16 stones have been delivered, an *end* has been played. The stones of one rink that are closer to the house's center than any stones of the opposing rink score one point each. The opposing rink receives no points in that end. Then the rinks repeat the process, sliding the stones toward the house at the other end of the ice.

Players deliver the stones from a *hack* (foothold) 126 feet (38 meters) from the center of the house at the opposite end of the ice. The 42½-pound (19.3-kilogram) stones used in Canada and the United States have flat tops and bottoms. Each stone has a handle on top.

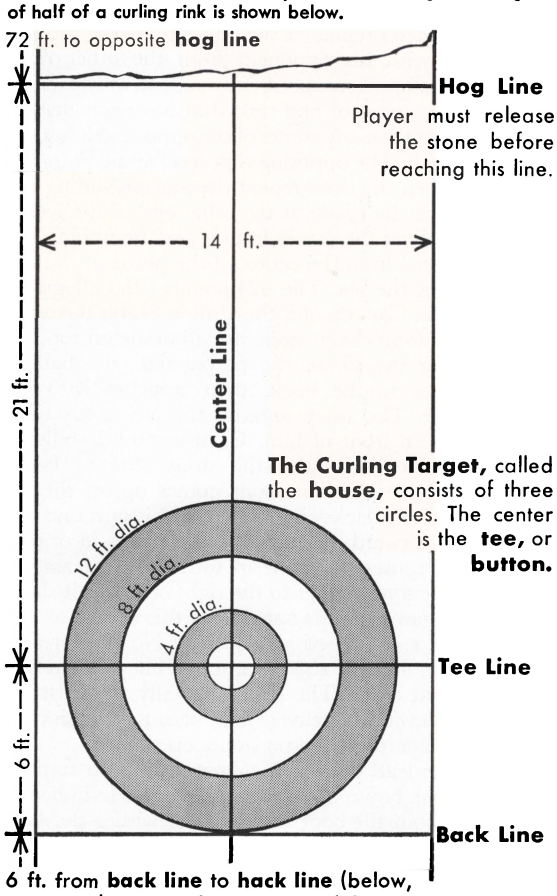
To deliver the stone, the player puts the ball of his right foot in the hack, then crouches with his feet together. The stone rests on the ice to his right and slightly in front of him. Grasping the handle in his right hand, he slides the stone straight back, rising as he does so. The stone comes up off the ice at the top of his backswing. Then, as his arm and the stone swing forward, he turns his arm either in or out. This action causes the stone to turn as he releases it, and it *curls* (curves) either to the right or left as it slides along. The game gets its name from this action.

The Rink is composed of a lead, a No. 2 player, a No. 3 player, and the *skip* or captain. They deliver the stones in that order. The lead is usually the least experienced player. He delivers first, because it is simpler to deliver when there are no stones on the ice.

Before the lead delivers his stones, the skip stations himself in the house at the opposite end. He indicates with his broom the spot at which he wishes the lead to aim his stone. After the lead delivers his stone, the skip judges its speed. If he thinks it will fall short of the target, he shouts a command, "Sweep." The

Milwaukee Journal

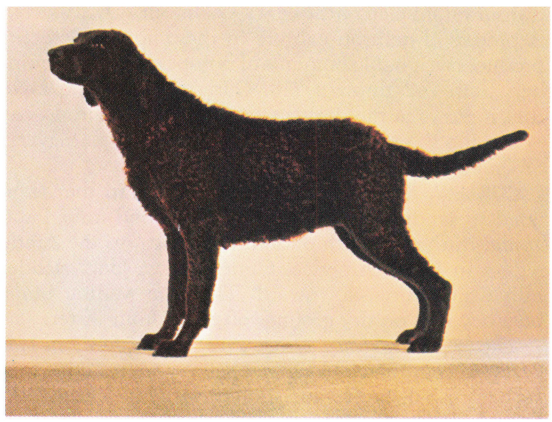
Curling Players Sweep the Ice so that the large, round stones will be able to slide easily toward the target. A diagram of half of a curling rink is shown below.



6 ft. from back line to hack line (below, not shown), where player begins delivery

other two players then run ahead of the sliding stone, sweeping the ice vigorously. Sweeping smooths the ice surface and lessens resistance to the stone. Curling experts believe sweeping can add 6 to 10 feet (1.8 to 3 meters) to a delivery. When the skip wants the sweepers to stop sweeping, he shouts, "Brooms up." After the lead delivers his stones, he joins another player in sweeping while his rinkmates deliver their stones.

CURLY-COATED RETRIEVER is a dog trained to bring back game that has been shot. It gets its name from its black or liver-colored coat, which is a mass of thick, tight curls. This coat keeps the dog from getting chilled



WORLD BOOK photo by E. F. Hoppe

The Curly-Coated Retriever Is a Good Hunting Dog.

while swimming. The curly-coat will work in cold water for a long time. It stands about 24 inches (61 centimeters) high at the shoulder, and weighs from 60 to 70 pounds (27 to 32 kilograms). A curly-coat is fairly easy to train, and makes a good guard or watchdog. See also RETRIEVER.

MAXWELL RIDDLE

CURRANT is a small berry that is closely related to the gooseberry. The plant is a low, bushy shrub. Currants are round and smooth, and have a tart flavor.

Both the *red currant* and the *black currant* grow wild in Northern Europe, and are easily grown in cool, moist regions of North America. The red currant is used to make jellies, jams, wines, and pies. The black currant is more popular in Canada and Europe, and has a sharper flavor than the red currant. White and yellowish currants are usually eaten as a fresh dessert. The *golden currant*, or *Missouri flowering currant*, grows wild in North America. It is popular as a garden plant.

Currant plants serve as a shelter for the fungus that causes the disease *white pine blister rust*, which is harmful to white-pine trees. It is unlawful to grow currant plants in states which have large white-pine forests.

Scientific Classification. Currants belong to the saxifrage family, *Saxifragaceae*. The red currant is genus *Ribes*, species *R. rubrum*. The black currant is *R. nigrum;* the golden currant, *R. aureum*.

ROY E. MARSHALL

See also GOOSEBERRY; ROTENONE; SAXIFRAGE.

CURRENCY. See MONEY (table: Money Terms).

CURRENT, ELECTRIC. See ELECTRIC CURRENT.

CURRENTS, OCEAN. See OCEAN (How the Ocean Moves).

CURRICULUM, *kuh RIHK yuh luhm,* is the whole range of formal studies and other learning experiences offered by a school. In most schools, subjects studied in the classroom form the chief part of a curriculum. But a curriculum may also include independent study and investigation; lectures by outsiders; participation in school athletics, plays, and concerts; educational television programs; field trips; and work or service projects in the community.

A curriculum organizes all learning experiences to give a student the most benefit from them at each level of his school career. A well-planned curriculum gives all subjects and activities a place in relation to one another.

Curriculum Content. The United States, unlike some nations, has no official national curriculum that all schools must follow. Under the Constitution, each state operates its own school system. The states allow local school districts much freedom in planning their own curriculums.

In spite of the lack of central control, there are many similarities among school curriculums throughout the United States. Reading, writing, and arithmetic—the subjects that once made up the entire curriculum of elementary schools—are still taught in some form throughout a person's educational career. Other required subjects in most curriculums include the fine arts, health and physical education, history, science, and social studies.

In middle school or junior high school, students may start taking *electives,* which are courses chosen from among nonrequired ones. Many middle schools and junior and senior high schools offer short electives called *minicourses.* Most high schools give instruction in homemaking, industrial arts, and other subjects that help prepare students for careers. Students who plan to attend college take courses, such as foreign languages, that enable them to meet college entrance requirements.

Many schools offer *individualized instruction* plans. Such plans allow students to learn at their own pace, using instructional materials prepared in the local district or school or produced by educational publishers. The teacher helps each student decide when he is ready to advance to the next level.

In some communities, *schools without walls* permit older students to pursue their studies in libraries and museums. Some of these students gain practical experience in business, industry, government, and social agencies.

In college, the curriculum becomes more specialized. Students may study for a professional career, such as education, engineering, law, or nursing. Or they may follow a general or liberal arts curriculum, in which they choose a *major* (special area of study), such as history or mathematics. They may also choose a *minor* (secondary field of specialization).

Curriculum Planning is a cooperative task in which the school administration and teaching staff play the leading roles. In developing a curriculum, each school considers the needs of its students; the requirements of federal, state, and local authorities; and the demands of the community. In some schools and colleges, students serve on student-faculty curriculum committees. Parents and community representatives contribute to curriculum planning. Help may also come from publishers and from research organizations and manufacturers that develop and produce equipment and materials.

Curriculum Change occurs as knowledge expands into new fields or as social problems force the development of new ideas and attitudes. During the late 1950's and 1960's, for example, the exploration of space and the growth of computer technology caused a demand for more engineers, mathematicians, and scientists. This need led to the development of new content and new teaching methods in science and mathematics courses.

Also during the 1960's, minority groups increasingly demanded curriculums that had relevance to their problems and achievements. These demands led to new courses presenting the culture, history, and problems of blacks, American Indians, and Mexican Americans. The early 1970's brought the development of a new field of study called *career education.* Offerings in this field included courses to help solve the problems of school dropouts, the changeover from school to job, and job changes required by new technologies.

During the 1970's, crime, drug abuse, and poverty resulted in increasingly serious problems. Concerned citizens, teachers, and students demanded that curriculums bear relevance to those problems. Many schools turned to their communities for help in meeting such demands. Community councils were set up to advise some schools. Community volunteers and tutors help in classrooms and take part in other activities.

Also in the 1970's, some state legislatures passed *accountability* laws to force school districts to account for their expenditure of school tax funds. Under an accountability system, a school must show how well its students are achieving the required performance levels in learning.

WILLIAM M. ALEXANDER

See also EDUCATION (What Should Be Taught?); ELEMENTARY SCHOOL (Instruction); HIGH SCHOOL (High-School Programs); JUNIOR HIGH SCHOOL (Curriculum); UNIVERSITIES AND COLLEGES (Selecting Courses).

CURRIE, SIR ARTHUR WILLIAM (1875-1933), a Canadian soldier, won fame as an able administrator and a courageous officer in the second battle of Ypres during World War I. In 1917, he was appointed commander of all Canadian forces in Europe. After the war, he acted as Inspector-General of the Canadian Army. From 1920 until his death, he was principal and vice-chancellor of McGill University in Montreal. Currie was born in Napperton, Ont. He was educated in the Strathroy Collegiate Institute. He joined the Canadian Militia in 1895.

JEAN BRUCHÉSI

CURRIER AND IVES was a firm of American lithographers. The company published more than 4,000 color pictures showing the manners, customs, and sports of the times; the California gold rush; railroads and clipper ships; fires; and other historic events. The prints were widely used for decoration and for illustration. Published at low cost, the prints later became rare and costly.

Nathaniel Currier (1813-1888), the senior member of the partnership, issued his first two prints in 1835 in New York City. They were *The Ruins of the Merchants' Exchange* and *View of the Great Conflagration.* Currier was born in Roxbury, Mass. He served as apprentice to William S. and John B. Pendleton, brothers who oper-

Curry's Paintings portray rural Midwestern life. The artist painted *The Roadmenders' Camp* in 1929.

University of Nebraska, Lincoln, F. M. Hall Collection

Currier and Ives Prints provide a pictorial record of American life during the middle and late 1800's. The partners completed this lithograph, *Ice-Boat Race on the Hudson,* in 1874.

Museum of the City of New York, Harry T. Peters Collection

ated the first lithographing shop in Boston, before he opened his own shop in New York.

James Merritt Ives (1824-1895) served first as bookkeeper and later as artist and art director of the firm. After 1857, all prints carried the joint name. Currier retired in 1880, and Ives carried on the business with William Currier, the son of Nathaniel. Ives was born in New York City. S. W. HAYTER

CURRY is a seasoning that is most often used with lamb, veal, chicken, and shrimp dishes. It is used as either a sauce or powder. Curry originated in India. It contains turmeric, an aromatic root that gives it a yellow color. Curry also contains garlic, pepper, ginger, cumin, and other spices. See also TURMERIC.

CURRY, JABEZ LAMAR MONROE (1825-1903), an American statesman and educator, worked for 60 years to make education possible for all Negro and white children in the South. He administered the George Peabody Fund for public education in the South after 1888, and served as agent of the Slater Fund for Negro Schools after 1890. In 1899, he became president of the Southern Educational Board.

Curry served in the U.S. House of Representatives (1857-1861), in the Confederate Congress (1861-1863 and 1864), and in the Confederate Army (1864-1865). He was president of Howard College—now Samford University—(1865-1868), and United States minister to Spain (1885-1888 and 1902). Alabama placed a statue

of him in the Statuary Hall collection in Washington, D.C.

Curry was born in Lincoln County, Georgia. He was graduated from the University of Georgia and from Harvard Law School. RICHARD N. CURRENT

See also PEABODY EDUCATION FUND.

CURRY, JOHN STEUART (1897-1946), an American painter, became famous for his dramatic scenes of Midwestern rural life and for his murals. His paintings hang in many museums throughout the United States. The best known of his works include *Baptism in Kansas* and *Tornado Over Kansas*. Curry painted murals for the U.S. Department of Justice and the Department of the Interior buildings in Washington, D.C., and for the Kansas Capitol in Topeka. Curry belonged to the movement among the artists of the 1930's known as regionalism, which was an attempt to recapture the American scene.

Curry was born in Dunavant, Kans. He studied at the Kansas Art Institute, at the Art Institute of Chicago, and then for a year in Paris. MILTON W. BROWN

CURTIN, JOHN JOSEPH (1885-1945), was prime minister of Australia during World War II. He united the nation behind the war effort, and introduced military draft despite his party's traditional opposition to it. Curtin realized that the United States would play the major role in the war in the Pacific. He allowed U.S. General Douglas MacArthur to use Australia as a base in the fight against Japan.

Curtin was born in Creswick, Victoria. He entered Labour Party politics as a youth and served in Parliament from 1928 to 1931 and from 1934 until his death. In 1935, he became Labour Party leader, and healed a major party split. He served as prime minister from 1941 to 1945. ROBIN W. WINKS

CURTIS, CHARLES (1860-1936), served as 31st Vice-President of the United States under President Herbert Hoover. He had served in the U.S. House of Representatives from 1893 to 1907, and in the U.S. Senate from 1907 to 1913 and 1915 to 1929. Curtis was an experienced parliamentarian as a member of the Senate Rules Committee. He became majority leader of the Senate during President Calvin Coolidge's administration, and gained fame for his ability to have the Senate complete its work without extra sessions.

Curtis, whose mother was part Kaw Indian, was born in North Topeka, Kans. As a youth, he worked as a jockey. But his interest turned to law, and he was admitted to the bar in 1881. He practiced law successfully, and became Shawnee County attorney. IRVING G. WILLIAMS

See also VICE-PRESIDENT OF THE UNITED STATES (picture).

CURTIS, CHARLES G., an American inventor. See TURBINE (History).

CURTIS, CYRUS HERMANN KOTZSCHMAR (1850-1933), an American publisher, founded the Curtis Publishing Company in 1890. He started his first publication, *Young America*, as a 12-year-old newsboy. Later he moved to Boston and, in 1872, founded a magazine called *The People's Ledger*. Four years later, he took this publication to Philadelphia. There, Curtis started another magazine, *The Tribune and Farmer*, which became the *Ladies' Home Journal* in 1883. Curtis bought *The Saturday Evening Post* in 1897 and *The Country Gentleman* in 1911.

Curtis also owned and published eight large daily newspapers. They included the *Philadelphia Public Ledger*, which he bought in 1913. Curtis purchased the *Philadelphia Press* in 1920, the *New York Post* in 1924, and the *Philadelphia Inquirer* in 1930. He organized the Curtis-Martin Newspapers, Inc., a newspaper chain, in 1925.

Curtis was born in Portland, Me. He engaged in many philanthropic activities. JOHN ELDRIDGE DREWRY

CURTIS ACT. See INDIAN TERRITORY.

CURTIS INSTITUTE OF MUSIC in Philadelphia prepares gifted students for professional careers. All students are on full-time scholarships. The institute was founded and endowed in 1924 by Mary Louise Curtis Bok, and named for her father, Cyrus H. K. Curtis. It grants degrees of Mus.B., Mus.M. (in composition), and honorary Mus.D. The institute's faculty has included such distinguished musicians as Leopold Auer, Josef Hofmann, William Kincaid, Moriz Rosenthal, Carlos Salzedo, Rudolf Serkin, Martial Singher, and Efrem Zimbalist. The enrollment of the Curtis Institute of Music is about 140. JAY H. MATTIS

CURTIS PUBLISHING COMPANY. See PHILADELPHIA (Publishing).

CURTISS, GLENN HAMMOND (1878-1930), an American inventor, made important contributions to the development of aircraft. He became a successful manufacturer of airplanes, and made thousands of planes during World War I. His Wasp held a number of records. In 1919, a Navy-Curtiss flying boat, commanded by Albert C. Read, made the first flight across the Atlantic Ocean.

Curtiss was born in Hammondsport, N.Y., and educated in the town's elementary schools. An interest in bicycle racing as a boy led to his flying career. From bicycles he turned to building motorcycles, one of which he raced at 137 miles (220 kilometers) per hour. In 1904, he began building engines for the first dirigibles in the United States, designed by Thomas Scott Baldwin. Curtiss built his first engine for an airplane in 1907, as a member of Alexander Graham Bell's Aerial Experiment Association. The next year, he helped design an airplane called the *June Bug*. It had a box tail and was controlled by *ailerons* (hinged flaps on the wings). Orville and Wilbur Wright had obtained a patent on a method of twisting wings to control flight. They claimed Curtiss' ailerons violated their patent. The Wright brothers won a court suit against Curtiss.

In 1910, Curtiss won $10,000 by flying one of his planes from Albany, N.Y., to New York City in 2 hours, 51 minutes. He built the first planes for the United States Navy in 1911 after demonstrating that planes could land and take off from ships. PAUL EDWARD GARBER

See also AIRPLANE (picture: The *June Bug*).

CURVE. See PARABOLA; CIRCLE; BASEBALL (picture: Pitching); BOWLING.

CURZON LINE was the eastern boundary of Poland proposed by the Allies in 1919, after World War I. It was named for Lord George Curzon, a British diplomat. Before the war, Poland had been divided among Austria-Hungary, Germany, and Russia. The line was to be the frontier between Russia and a new Poland. Both countries rejected the plan, and fighting broke out in

1920. The Treaty of Riga in 1921 moved the border east of the Curzon Line. The line is now the boundary between Poland and Russia. WILLIAM A. JENKS

See also POLAND.

CUSA, NICHOLAS OF (1400-1464), was a German cardinal, theologian, and scholar. As a priest, he favored the reform of the calendar and the unity of Christendom. He was sent to Constantinople to bring about the reunion of the Eastern Church with the church in the West. In 1449, he was made a cardinal. Pope Nicholas V sent him as papal legate to Germany to bring about various reforms within the church. As a scientist, he was perhaps the first to propose the hypothesis of the revolution of the earth around the sun. He was born at Cues, or Cusa, Germany. JAMES A. CORBETT and FULTON J. SHEEN

CUSCO, or CUZCO, *KOOS koh* (pop. 105,400), lies in southern Peru. For the location of Cusco, see PERU (color map). Cusco was the capital of the Inca Empire. Francisco Pizarro, the Spanish soldier, took it in 1533. Cusco has many Inca and Spanish colonial buildings. The city is a trading center for nearby farmers. C. LANGDON WHITE

CUSCUS is a mammal that grows about as big as a house cat. It lives in trees in New Guinea, Indonesia, and the northern tip of Australia. The cuscus moves slowly and is most active at night. It has large eyes, woolly fur, and short ears. The fur varies from all white to all black, and some individuals are spotted. The base of the tail is woolly, but the tip is covered with coarse scales. The cuscus eats both animal and vegetable matter. It is easily caught, and is often used as food.

Scientific Classification. The cuscus belongs to the order *Marsupialia*. It is in the phalanger family, *Phalangeridae*. A common cuscus is classified as genus *Phalanger*, species *P. maculatus*. FRANK B. GOLLEY

See also MARSUPIAL; PHALANGER.

CUSHING, HARVEY (1869-1939), an American physician and surgeon, was one of the world's greatest brain surgeons. He won fame for his achievements in neurosurgery and for experimental work on the brain, nervous system, and pituitary gland.

In 1926, Cushing won a Pulitzer prize in biography for *The Life of Sir William Osler* (1925), the life story of his friend and fellow physician. His other writings include a surgical and physiological classic, *The Pituitary Body and Its Disorders* (1912), and *Tumors of the Nervus Acusticus* (1917) and *From a Surgeon's Journal, 1915-1918* (1938).

Cushing joined Johns Hopkins University in 1896. He was made associate professor of surgery in 1903. He was professionally connected with the university until 1911, when he became professor of surgery at Harvard. He was born in Cleveland, studied medicine at Harvard, and was graduated in 1895. NOAH D. FABRICANT

CUSHING, RICHARD CARDINAL (1895-1970), an American religious leader, was named a cardinal of the Roman Catholic Church in 1958 by Pope John XXIII. He had gained wide recognition as a gifted writer and preacher. Ordained as a priest in 1921, Cushing engaged in parish work in Boston until the late 1930's. He was named auxiliary bishop of Boston in 1939. He served as archbishop of the archdiocese from 1944 until shortly before his death. He was a close family friend of President John F. Kennedy, and celebrated the marriage and funeral Masses of the President. Cushing was born in South Boston. JAMES A. CORBETT and FULTON J. SHEEN

CUSHMAN, CHARLOTTE (1816-1875), an American actress, won fame for her roles as Lady Macbeth in *Macbeth*, Meg Merrilies in *Guy Mannering*, and Nancy Sykes in *Oliver Twist*. Miss Cushman became the first member of the theatrical profession to win a place in the Hall of Fame. At the time of her last stage appearance, William Cullen Bryant presented her with a laurel crown. Miss Cushman began her career as a singer, but when she strained her voice, she turned to acting. She played Romeo and other male roles opposite her sister Susan early in her stage career. Miss Cushman was born in Boston. WILLIAM VAN LENNEP

CUSPID. See TEETH (Permanent Teeth).

CUSTER, GEORGE ARMSTRONG (1839-1876), an American army officer, won fame as an Indian fighter in the West. On June 25, 1876, Custer and about 225 men under his immediate command were killed by Indians in the Battle of the Little Bighorn. Not a man survived. This massacre, known as "Custer's Last Stand," became famous because of a controversy that began after the battle. The truth of all that happened in the battle will never be known.

Early Career. Custer was born in New Rumley, Ohio. As a boy, he wanted to be a soldier. In 1861, he was graduated at the bottom of his class at the U.S. Military Academy. The Civil War had just begun, and Custer won fame as a fearless cavalry leader. At the age of 23, he became the Union Army's youngest general.

Many who served with the "boy general" admired him. Many others hated him. Some of his enemies were jealous of him and called him a "glory hunter."

After the war, the Army dropped Custer to his permanent rank of captain. He joined the Seventh Cavalry Regiment in 1866, and later became a lieutenant colonel in command. He won greater fame and made more enemies as he fought Indians in the Southwest and in the Dakota and Montana territories.

The 1876 Campaign. In 1876, the Army planned to round up the Sioux and Cheyenne Indians and bring them onto reservations. Custer's regiment joined the expedition, commanded by General Alfred H. Terry.

As the troops moved into the Montana Territory, scouts reported that an Indian village lay somewhere ahead. Terry ordered Custer to find it. Four days later, on June 25, Custer saw the village about 15 miles (24 kilometers) away. It lay in a valley along the Little Bighorn River. Custer expected to find only about 1,000 Indians, who could be rounded up easily by the 650 men in his regiment. Actually, between 2,500 and 5,000 Indians were in the camp. It was the largest gathering of hostile tribes in Western history.

The Battle. Custer ordered an immediate attack. He divided his regiment into three columns—one under Captain Frederick W. Benteen, one under Major Marcus A. Reno, and one under himself. Benteen was ordered off to the left to search the mountain valleys for Indians. Custer ordered Reno to charge ahead across the river and attack the Indian village. Custer's column advanced into the bluffs to the right, presumably to attack the side or the rear of the Indian village.

Brown Bros.
George A. Custer

After bloody fighting in the valley, Reno retreated across the river and up the bluffs. Benteen's column joined Reno's men. The soldiers held off the Indians until Terry arrived on June 27.

About 5 miles (8 kilometers) away, sometime during the fighting in the valley and the first shooting on the bluffs, the Indians wiped out Custer and his entire column.

The Controversy over the battle began almost immediately. Custer's enemies accused him of disobeying Terry and of seeking greater glory by attacking the Indians. However, Terry's written orders had given Custer full discretion. Custer's supporters charged that Reno had been a coward, and could have rescued Custer if he had not retreated.

Many authors have defended Custer, and many have supported Reno. Various books also have theorized about Custer's plans after dividing his regiment, and about the events of the battle in which he was killed. But no one really knows. JAMES D. SHACTER

See also CRAZY HORSE; INDIAN WARS (The Sioux Wars); RENO, MARCUS A.; SITTING BULL.

CUSTER BATTLEFIELD NATIONAL MONUMENT is in southeastern Montana. It includes part of the site of the Battle of the Little Bighorn. The 765.34-acre (309.72-hectare) area was a national cemetery from 1879 until it was established as a national monument on March 22, 1946. See also MONTANA (color picture).

CUSTIS, GEORGE WASHINGTON PARKE (1781-1857), grandson of Martha Washington, became the adopted son of George Washington. He is known for his *Recollections of Washington* (1860) and for his plays. One of them, *Pocahontas*, told the story of the Indian princess and Captain John Smith. In another play, Custis brought a locomotive steam carriage onto the stage. He was born in Mt. Airy, Md. His mansion became the home of his son-in-law, General Robert E. Lee. It stands in Arlington National Cemetery, across the Potomac River from Washington, D.C. ARVID SHULENBERGER

See also WASHINGTON, GEORGE (picture: Washington's Family).

CUSTIS, MARTHA. See WASHINGTON, MARTHA CUSTIS.

CUSTOM is the practice of preserving ideas and actions from generation to generation. The term also refers to a specific act that follows the traditions of past generations. Customs vary widely from place to place and from group to group. They also vary throughout the history of a particular group.

Not all customs are equally important. *Mores* are customs that people regard as extremely important. Violators of mores may receive severe punishment. In the United States, for example, a man or woman may go to prison for marrying more than one person at a time. Other customs, called *folkways*, are not so important, and persons who do not observe them receive only mild

Custer Was Killed by Indians During the Battle of the Little Bighorn in 1876.

Custer's Last Stand (1899), an oil painting by Edgar S. Paxson; Whitney Gallery of Western Art, Cody, Wyo. Courtesy of William Edgar Paxson

punishment. Folkways include eating habits, ways of dressing, and methods of playing games.

Most persons usually follow the traditions handed down to them. They rarely ask why the customs are what they are, or whether some other way of doing things might not be better. Much training in schools, at home, and elsewhere consists of teaching customs and making people observe them as completely as possible. People conform to customs because it is easier than not doing so. Society often ridicules and punishes persons who do not observe custom. JOHN F. CUBER

Related Articles. See the various country articles where customs are discussed, such as INDIA (Ways of Life). See also the following articles:

Amusements	Feasts and Festivals	Holiday
Anthropology	Feud	Kiss
Beard	Folklore	Mores
Cannibal	Folkway	Religion
Clothing	Food	Segregation
Culture	Funeral Customs	Shelter
Duel	Hairdressing	Siesta
Etiquette	Hara-Kiri	Sociology
Fashion	Harem	Vendetta

CUSTOMS COURT, UNITED STATES, reviews and settles disputes between collectors for the U.S. Customs Service and importers and exporters. For example, the court may settle a disagreement over the value placed on imported merchandise.

The court consists of nine judges appointed by the President of the United States. The President names one of these nine as chief judge. Not more than five judges may be appointed from the same political party. The judges hear cases in three divisions of three judges each. The court was created in 1890 as the Board of United States General Appraisers. It received its present name in 1926. Critically reviewed by the U.S. CUSTOMS SERVICE

See also COURT (diagram).

CUSTOMS DUTIES. See TARIFF; EXPORTS AND IMPORTS; FREE TRADE; CUSTOMS SERVICE, U.S.

CUSTOMS SERVICE, UNITED STATES, collects all duties, taxes, and fees due on merchandise imported into the United States. The agency cooperates with other government agencies in regulating the entrance and exit of goods and persons into or out of the country. Its inspectors check persons and their belongings as they arrive at U.S. ports of entry.

The service enforces laws against smuggling. It examines all export permits and declarations of a product's value. It may inspect merchandise to ensure that the goods entering or leaving the United States do not violate any law. It regulates the entry, departure, and certain domestic movements of ships, airplanes, and trucks engaged in international trade. It also regulates U.S. fishing vessels and supervises the use of U.S. territorial waters by foreign ships.

The U.S. Customs Service was set up in 1789 by the first Congress. Customs collections provided most government revenue for almost 125 years. Nine Customs regions are divided into 43 districts and 294 ports of entry. The service collected more than $4 billion a year in the early 1970's. An agency of the Treasury Department, it is directed by the commissioner of customs. Headquarters are at 2100 K Street NW, Washington, D.C. 20229. Critically reviewed by the U.S. CUSTOMS SERVICE

CUSTOMS UNION is an association of two or more countries to encourage trade. The countries making such an arrangement agree to eliminate duties and other restrictive regulations on trade among them. Members of the union apply a single set of tariffs to all countries outside the union. A *free trade area* is like a customs union, except that the members of a free trade area may apply separate tariffs against nonmembers.

The best-known customs unions have included the Zollverein, Benelux, and the European Economic Community (EEC). The Zollverein was formed by German states in the 1830's. These states became the German nation in 1871. Belgium, The Netherlands, and Luxembourg established Benelux in the 1940's. Belgium, France, Italy, Luxembourg, The Netherlands, and West Germany set up the European Economic Community in 1957. Britain, Denmark, and Ireland joined the community in 1973. HAROLD J. HECK

See also ZOLLVEREIN; BENELUX; EUROPEAN COMMUNITY; EUROPEAN FREE TRADE ASSOCIATION.

CUT GLASS. See GLASS (Cutting).

CUTANEOUS SENSE. See TOUCH.

CUTCH. See CATECHU.

CUTICLE. See NAIL (picture: Care of the Nails); SKIN.

CUTLASS FISH is a long, slender salt-water fish. It lives in waters of the West Indies, the western Pacific Ocean, and the southern United States. The cutlass fish has a long, pointed hairlike tail. Its lower jaw is longer than its upper jaw, and it has long, doglike teeth. It usually grows about 5 feet (1.5 meters) long. The *dorsal* (back) *fin* extends the length of the body. Cutlass fish living in Japanese waters swim into fairly shallow water to lay their eggs. The fish are caught for food in some areas.

Scientific Classification. The cutlass fish belongs to the cutlass fish family, *Trichiuridae*. It is classified as genus *Trichiurus*, species *T. lepturus*. LEONARD P. SCHULTZ

CUTTER. See COAST GUARD, UNITED STATES (Protecting Life; picture: A Modern Coast Guard Cutter).

CUTTER. See CLOTHING (Ready-to-Wear Clothes).

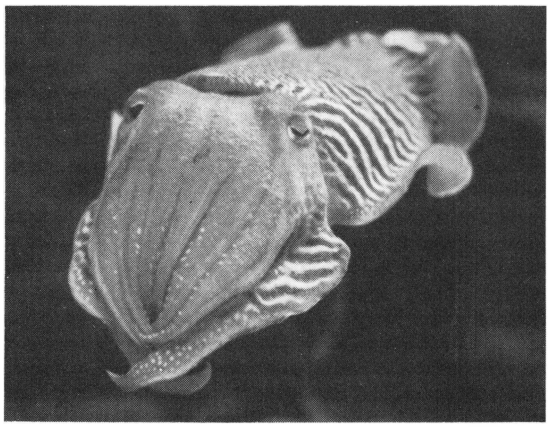
CUTTING. See PLANT (Vegetative Propagation).

CUTTLEFISH is a *mollusk* (soft boneless animal) in the same class as the squid. It is found in most seas except those surrounding the Americas. It usually occurs in deep water, but sometimes near the shore. It ranges in size from about 3 inches (8 centimeters) to about 6 feet (1.8 meters) long. The body is brown with crossbands and purple spots. It is brilliantly metallic in the sunlight, and often changes color. The cuttlefish's oval body is surrounded with a frilled fin.

The cuttlefish has eight short arms and two long *tentacles* (feelers) that surround the mouth. Both the arms and the tentacles have four rows of hard and rough suckers. The tentacles can be pulled into pockets behind the eyes. The cuttlefish uses its arms to attach itself to various objects, and to capture fish and other forms of marine life for food.

The cuttlefish has an internal shell called the *cuttlebone*. The broad cuttlebone is spongy and chalky. It is fed to canaries and parrots because of its lime food value. It is also used in making toothpaste.

The cuttlefish moves by forcing water in or out of the space between the cuttlebone and body. To hide from its enemies, the cuttlefish can darken the water as it moves by pouring out an inky substance containing



Schall, Pix

The Cuttlefish has a broad head with two large eyes. The sepia used by artists is made from the substance in its ink sac.

the brown *pigment* (coloring matter) called sepia. Ink made from sepia was widely used in ancient times.

Scientific Classification. The common cuttlefish is in the cuttlefish family, *Sepiidae*. It is classified in the genus *Sepia*, species *S. officinalis*. R. TUCKER ABBOTT

See also NAUTILUS; OCTOPUS; SQUID; MOLLUSK.

CUTWORM is the caterpillar of certain dull-colored, night-flying moths. Cutworms have a smooth skin and vary in color from light gray to black. Some are striped or spotted. Cutworms are quite destructive. Groups of cutworms have been known to destroy entire fields of young wheat, corn, or garden vegetables overnight. Cutworms also may cause a great deal of damage to tobacco, cotton, and various kinds of fruit trees.

From one to four generations of cutworms may grow each year. Some spend the winter as pupae, others as larvae. Solitary cutworms feed beneath the soil. Climbing cutworms crawl up the plants at night to feed. Gardeners kill both kinds of cutworms by using poisoned baits and sprays.

Scientific Classification. Cutworms are in the owlet moth family, *Noctuidae*. One kind, the variegated cutworm, is genus *Lycophotia*, species *L. margaritosa*. Another, the greasy cutworm, is *Euxoa ypsilon*. E. GORTON LINSLEY

See also MOTH.

CUVIER, *kyoo VYAY*, **BARON** (1769-1832), GEORGES LÉOPOLD CHRÉTIEN FRÉDÉRIC DAGOBERT CUVIER, was a French naturalist. He founded *comparative anatomy*, a branch of zoology that compares the body parts of different animals. Cuvier also began the science of *paleontology* (the study of fossils) when his comparisons led him to the fossil remains of prehistoric animals. He wrote *The Animal Kingdom*, which became a famous authoritative source on zoology.

Cuvier began his work by dissecting animals from the sea. He then dissected many large animals, including the rhinoceros and the elephant. He could usually identify an animal from a single bone or body organ. Cuvier proposed the theory of *geological catastrophe* to explain why many fossil animals were no longer alive. This theory held that great volcanic upheavals and similar catastrophes destroyed many forms of life.

Cuvier was born in Montbéliard, France. At the age of 14, he went to school in Stuttgart, Germany. He began to study sea animals while tutoring the son of a wealthy family on the Normandy coast. He later taught at the College of France. A. M. WINCHESTER

See also ZOOLOGY (The Development of Zoology).

CUZCO. See CUSCO.

CYANIDE, *SY uh nide*, is the name given to metal salts containing the CN group (a carbon atom linked to a nitrogen atom). Sodium cyanide (NaCN), and potassium cyanide (KCN) are important industrial chemicals. Potassium cyanide is used in the cyanide process of separating gold from its ores. Strong acids react with metal cyanides to make hydrogen cyanide (HCN), a deadly poison gas. Organic cyanides are *nitriles*. Acrylonitrile, an important plastics ingredient, is made from cyanide. Chemists use cyanide in solutions for electroplating. They also use it in producing drugs and other chemicals. JAMES S. FRITZ

See also GAS CHAMBER; PRUSSIC ACID.

CYANITE. See KYANITE.

CYANOSIS, *sy uh NO sis*, is a bluish color of the skin and mucous membranes. The condition usually results when not enough oxygen is present in the arterial blood. Cyanosis often occurs in persons who live at high altitudes, where the oxygen in the air is reduced. Certain kinds of lung diseases and heart diseases also can cause cyanosis. *Blue babies* have a great degree of cyanosis because the circulation of blood through their hearts is defective (see BLUE BABY). Doctors often give patients with cyanosis oxygen by means of oxygen tents or masks. See also OXYGEN TENT. WILLIAM DAMESHEK

CYBELE. See RHEA (goddess).

CYBERNETICS, *sy bur NET icks*, is a branch of science that deals with control mechanisms and the transmission of information. Its name comes from a Greek word meaning *steersman*. The word *cybernetics* was adopted by the American mathematician Norbert Wiener, who wrote *Cybernetics* (1948).

Wiener noted that the means for internal control and communication in an animal, such as its nervous system, were similar to those in a machine. He also realized that biologists who studied animals, and engineers who designed automatic control equipment, did not usually know each other's fields of work. He proposed that control and communication in both fields be studied together as the science of cybernetics

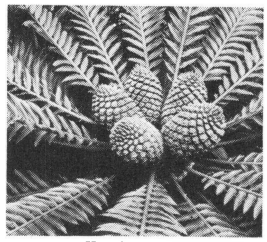
An important part of cybernetics is the study of *feedback*. If the path of a guided missile is not what it is supposed to be, or if the body temperature of a man is too high or too low, information concerning the error is *fed back* to the controlling device, which then acts to correct the error. STANFORD GOLDMAN

See also AUTOMATION (Feedback); INFORMATION THEORY; WIENER, NORBERT.

CYCAD, *SY cad*, is a large subtropical and tropical seed plant. It is related to cone-bearing trees such as the pine and spruce, but looks like a palm or fern. Some cycads have unbranched, erect stems that may be 60 feet (18 meters) high. Others have a partially underground stem, called a tuber, that resembles a potato. Some species reach ages of nearly a thousand years.

The cycad's leathery, fernlike leaves grow in a circle at the end of the stem. New leaves grow every year and live several years. The cycad has a

strobilus (large cone) that contains seeds. The cone grows erect in the center of the circle of leaves. When the seeds mature, part of the strobilus shrivels, allowing the seeds to drop to the ground.



Huntington Bot. Gardens

The Cycad Plant, like the pine, bears its seeds in cones.

Scientists have found fossils which show that cycads were common during prehistoric times. The cycads are the most primitive seed plants, but not necessarily the most ancient. They grow in only a few small areas. One kind, called *Zamia,* is common in tropical America.

Scientific Classification. Cycads belong to the cycas family, *Cycadaceae.* RICHARD J. PRESTON, JR.

See also CONE-BEARING PLANT; GYMNOSPERM; SEED.

CYCLADES, *SIHK luh deez,* are a group of more than 200 Greek isles lying off the southeastern coast of Greece in the Aegean Sea. For location, see GREECE (color map). Their name comes from the Greek word *kyklos,* meaning *circle.* The Cyclades form a protective circle around the sacred isle of Delos, the central and smallest island of the group. In Greek mythology, Delos once floated, but Poseidon anchored it in place to become the birthplace of Apollo.

The chief islands of the Cyclades are Andros, Paros, Tinos, Naxos, and Síros. The Cyclades have a combined area of 993 square miles (2,572 square kilometers), and a combined population of about 100,000. Chief products include olives, grapes, fish, tobacco, hides, marble, and limestone. The capital and principal city of the Cyclades is Síros, or Ermoúpolis. HARRY N. HOWARD

See also MELOS; PAROS.

CYCLAMEN, *SYKE luh men,* is an attractive plant of the primrose family. Cyclamens grow wild in the Mediterranean region of Europe and are cultivated in homes and greenhouses in America. The leaves and flowers of the cyclamen spring from a swollen, turniplike root. Most of the leaves are veined in silver. The dainty flowers are white, rose, or purple, and have no fragrance. They measure about $2\frac{1}{2}$ inches (6.4 centimeters) long. The petals turn back as though the flowers were inside out. Cyclamens are grown from seed. They need rich soil, abundant water, and temperatures from 50° to 60° F. (10° to 16° C). The cyclamen blooms during the winter months.

Scientific Classification. The cyclamen belongs to the primrose family, *Primulaceae.* It is classified as genus *Cyclamen.* MARCUS MAXON

See also FLOWER (color picture: Enjoying Flowers Indoors); PRIMROSE.

CYCLE. See ELECTRIC CURRENT; GASOLINE ENGINE (Cycle); LIFE CYCLE; OCEAN (The Food Cycle in the Sea); WATER (Nature's Water Cycle).

CYCLONE is a low-pressure area in the atmosphere in which winds spiral inward. A cyclone may cover an area half as large as the entire United States. A special, intense kind of cyclone usually only 300 yards (274 meters) across is a *tornado.*

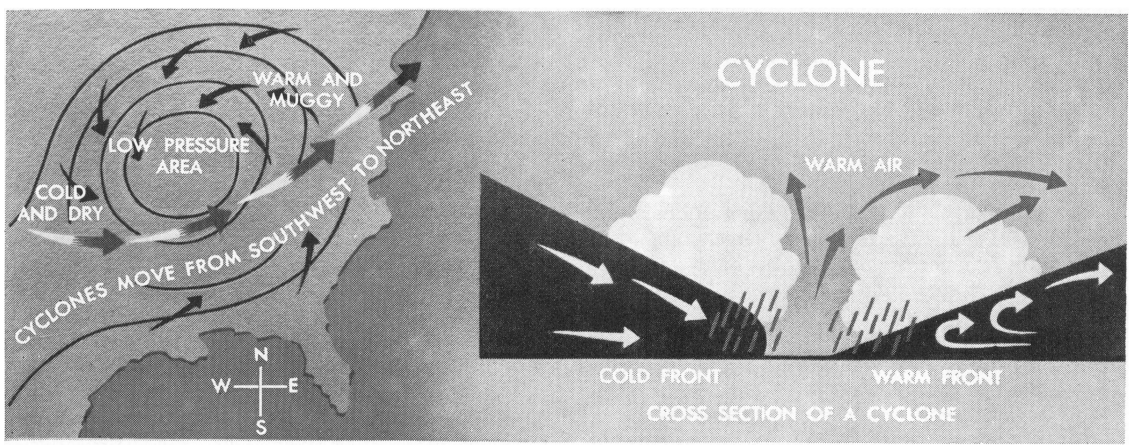
All cyclones have two characteristics: (1) the atmospheric pressure is lowest at the center, and (2) the winds spiral in toward the center. In the Northern Hemisphere, the winds blow counterclockwise. In the Southern Hemisphere, they blow inward in a clockwise direction. Cyclones move at speeds ranging from 240 to 1,200 miles (386 to 1,930 kilometers) a day.

Some parts of the world have so many cyclones that their average atmospheric pressure is below that of the rest of the world. For example, in the *Aleutian low* in the North Pacific Ocean, the pressure is low most of the winter. Such a region may be called a *semipermanent* low pressure center or a *center of action.*

Storms usually occur with cyclones. The falling atmospheric pressure usually serves as a fairly good indication that bad weather is coming. Sometimes, however, cyclones do not bring bad weather. This is because the kind of air also has much to do with the weather. If a cyclone forms in dry air, for example, there may not be any clouds.

A tropical cyclone is a severe kind of cyclone that occurs over warm ocean waters in the tropics. The cyclones are called *hurricanes* if they form in the West Indies, and *typhoons* if they form in the Pacific Ocean. These storms may bring winds up to 180 miles (290 kilometers) an hour, terrific rains, violent thunder, and lightning.

Cyclones may be either warm-core or cold-core types. *Warm-core* cyclones are warmer at the center than near



the edges. They are fairly shallow and become weaker in the upper atmosphere. They often occur over especially warm land areas, such as the desert of the southwestern United States. *Cold-core* cyclones are coldest near the center and warmer near the edges. These cyclones may be very deep, and are more intense several thousand feet in the air than they are at the surface of the earth. GEORGE F. TAYLOR

See also HURRICANE; TORNADO; WEATHER; WIND.

CYCLONITE. See RDX.

CYCLOPEDIA. See ENCYCLOPEDIA.

CYCLOPROPANE. See ANESTHESIA.

CYCLOPS, *SY klahps*, was one of a race of giant shepherds in Greek mythology. They lived in Sicily, and each of them had only one eye in the center of his forehead. They made weapons and armor for the gods. Apollo destroyed them because they made the thunderbolt used to kill his son Asclepius. See also ASCLEPIUS; APOLLO; POLYPHEMUS. PADRAIC COLUM

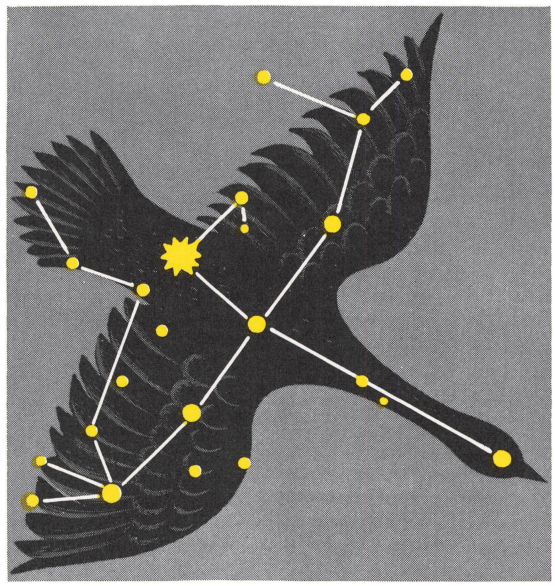
CYCLORAMA, *sy kloh RAHM uh*, is a painting done on a curved surface. The painting usually pictures a scenic panorama or an historical event. The artist tries to make the painting extremely realistic, and gives much attention to achieving a deep perspective. He plans the cyclorama so that when a person sees it, he feels that he is a part of the scene represented. The cyclorama is usually in a large circular room, with lighting designed to heighten the realistic effect of the work.

Cycloramas on the Civil War include one at Atlanta, Ga., which depicts the Battle of Atlanta, and one at Gettysburg, Pa., picturing the Battle of Gettysburg. A cyclorama at Waterloo, Belgium, shows Napoleon's defeat at Waterloo. *Cyclorama* also refers to the backdrop curtain on a theater stage. WILLIAM M. MILLIKEN

See also CIVIL WAR (picture); DIORAMA.

CYCLOTRON is an atom-smashing machine, or *particle accelerator*. The American physicist, Ernest O. Lawrence, invented the cyclotron in 1930. He had the idea that a charged particle such as a proton could be bent into a circular path by the action of an intense magnetic field, instead of accelerating it in a straight line, as is done in a linear accelerator. He put a vacuum chamber containing two D-shaped electrodes, called *dees*, between the poles of a powerful magnet. A high-frequency voltage (rapidly changing electrical charges) was applied to the electrodes. Protons were started out at the center of the chamber. As they moved into the space between the dees, the change of charge acted like a push on a swing and speeded them up. The magnetic field kept them going in a circular path so that they entered the next dee. Each time they crossed the dee separation, they acquired another boost in energy. Their increased speed caused them to spiral farther away toward the outer edge of the chamber. Finally, at their maximum energy, they hit a target near the edge of the chamber. Many cyclotrons have been built in this country and in foreign lands. They are used to accelerate helium nuclei, or *alpha particles*, to as high as 50 million electron volts (mev); deuterons, or nuclei of heavy hydrogen, to 25 mev; and protons to 10 mev. Extremely heavy ions may be accelerated up to 200 mev. These particles can be made to emerge from the cyclotron as a beam. When they bombard various elements, they produce radioisotopes. RALPH E. LAPP

See also PARTICLE ACCELERATOR; DEUTERIUM.



The Constellation Cygnus, or The Swan

CYGNET, a young swan. See SWAN.

CYGNUS, *SIHG nuhs*, is a constellation in the Northern Hemisphere. Its most prominent feature is the Northern Cross, which is formed by its five brightest stars. The brightest star, Deneb, marks the upper end of the cross toward the northeast. The double star Albireo marks the foot of the cross toward the southwest. In mythology, Cygnus often stands for the swan into which Jupiter (Zeus) changed himself in order to court Leda. I. M. LEVITT

CYLINDER. See GASOLINE ENGINE.

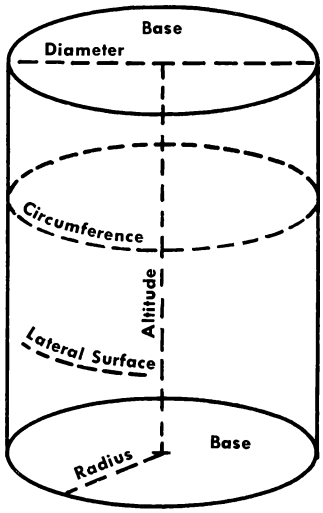
CYLINDER, *SILL in duhr*, is a solid bounded by a curved *lateral surface*, or side, and two flat surfaces called *bases*. The two bases have the same area and are bounded by circles or other closed curves. Objects with cylindrical shapes, although usually not solids, may be seen every day. A tin can has a cylindrical shape. So do a water pipe and a soda straw. Examples of cylinders that are solids include the handle on a rake or a fence post made from a log. See CIRCLE.

You can easily test whether an object is a cylinder. Place a pencil so that it touches the curved surface in a straight line. Move the pencil so that this straight line moves around the curved surface. On a cylinder, the pencil will always point in the same direction. That is, all its positions will be parallel to each other. In a *right circular cylinder*, such as a tin can, this line is perpendicular to the bases. In other kinds of cylinders, the line may form less than a right angle with the bases.

Parts of a Cylinder. In a right circular cylinder, the radius of each of the bases is the *radius of the cylinder*. The diameter of the bases is the *diameter of the cylinder*, and their circumference is the *circumference of the cylinder*. The perpendicular distance between the bases of a cylinder is its *altitude*.

The Area of the Lateral Surface of a right circular cylinder equals the area of a rectangle whose length equals the circumference of the cylinder, and whose width equals the altitude of the cylinder. Thus, to fi-

the area of the lateral surface, multiply the circumference by the altitude. If L stands for the area of the lateral surface, r for the radius of the cylinder, and h for the altitude, then $L = 2\pi rh$.



The Volume of a Cylinder equals the product of the area of one base times the altitude. If V stands for the volume, r for the radius of the base, and h for the altitude, then $V = \pi r^2 h$.

The Total Area of a Cylinder equals the area of the lateral surface plus the area of the bases. If A stands for the total area of a cylinder, then $A = L + 2\pi r^2$, or $A = 2\pi r(h + r)$. MILES C. HARTLEY

CYLINDER BLOCK. See GASOLINE ENGINE (Parts).

CYLINDER PRESS. See PRINTING (Running the Presses; color picture).

CYMBAL, *SIHM buhl*, is a circular brass percussion instrument, shaped like a broad-brimmed hat. It has a small *boss*, like the crown of a hat, in the center. A leather thong attached to the boss serves as a handle. A variety of sound effects can be obtained by striking two cymbals together, or by striking one cymbal with beaters. Cymbals come in all sizes, but most percussionists in symphony orchestras prefer cymbals with a diameter of 14 or 15 inches (36 or 38 centimeters). Cymbals are hand-made, and no two sound exactly alike.

Objects resembling cymbals were found in the ruins of an Indus civilization of 3000 B.C. They were used in Israel as early as 1100 B.C. The name comes from the Greek, *kymbalon*, meaning *hollow of a cup*. Cymbals made their earliest orchestral appearance in 1680 in the opera *Esther*, in Hamburg, Germany. The finest cymbals are made by an Armenian family, Zildjian, which has held the secret since 1623. CHARLES B. RIGHTER

See also MUSIC (Percussion Instruments).

CYMBELINE. See SHAKESPEARE, WILLIAM (Shakespeare's Plays).

CYME, *sym*, is a type of flower, each stalk of which has a blossom. They are produced from the top downward, or from the center outward. Common examples of cymes include crab apples, forget-me-nots, phlox, and certain species of dogwood. See also INFLORESCENCE.

CYMRY. See CELT.

CYNEWULF. See ENGLISH LITERATURE (Beginnings).

CYNIC PHILOSOPHY was established in the 300's B.C. by Antisthenes, a disciple of Socrates. He took as his starting point the doctrine of his great teacher that virtue rather than pleasure is the chief end of life, and constitutes true happiness. He argued that the wise man is the one who looks with contempt on all the ordinary pleasures of life, and lives without regard for riches or honors. Continued happiness, he declared, is not possible if man has wants and desires which may not be satisfied. He is bound by no obligations to society, state, or family, because these things give rise to desires that cannot be satisfied.

Among the enthusiastic followers of Antisthenes was Diogenes, who carried the principles of the Cynics to an extreme. It is said that he lived on the coarsest bread and slept at night in a tub. Zeno, of the later Roman period, was another distinguished Cynic. The Cynics form the link between Socrates and the Stoics.

Some authorities say that the name *cynic* refers to *Cynosarges*, the name of the building in Athens where the Cynics first met. Others say that the name comes from the Greek word for dog, and refers to the rude manners of the Cynics. In ordinary speech, a person who sneers at the idea that goodness exists in human nature is often called a *cynic*. H. M. KALLEN

See also DIOGENES; STOIC PHILOSOPHY; ZENO.

CYNOSURE. See NORTH STAR.

CYO. See CATHOLIC YOUTH ORGANIZATION.

CYPRESS, *SY pruhs*, is any one of a group of tall evergreen trees that grow in North America, Europe, and Asia. There are about 13 species or kinds, six of which grow naturally in southwestern United States. The *bald cypress* is not a true cypress, but is related to the sequoia. Cypresses adapt readily to warm climates, and gardeners often use them as ornamentals. The trees have small, scalelike leaves that grow in dense fan-shaped sprays. Their globe-shaped cones are covered by woody scales that look like small shields. The wood is light brown, durable, and has a strong cedarlike odor.

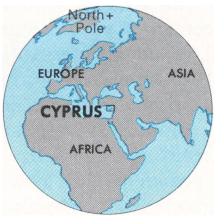
The *Monterey cypress* is one of the most picturesque trees in North America. It is named for the Monterey Peninsula of California, its native region. Its trunk is rather small, rarely more than 20 inches (50 centimeters) in diameter. It has long, strong, massive limbs that spread and grow in unusual shapes. The tree is gnarled and bent by strong ocean winds. It is a favorite subject for artists.

Scientific Classification. Cypresses belong to the cypress family, *Cupressaceae*. The Monterey cypress is genus *Cupressus*, species *C. macrocarpa*. RICHARD J. PRESTON, JR.

See also BALD CYPRESS; CONE-BEARING PLANT; TREE (Familiar Broadleaf and Needleleaf Trees [picture]).

CYPRESS GARDENS, Fla., is a beautiful garden and water playground on Lake Eloise. It lies near Winter Haven in central Florida. The site of the gardens was a wild swamp until the 1930's. It has been developed into gardens of rare and exotic plants from all parts of the world. Huge bald cypress and oak trees shade footpaths and banks of gardenias, azaleas, camellias, and other flowers. Water-skiing shows are held daily. See also FLORIDA (color picture). KATHRYN ABBEY HANNA

CYPRUS



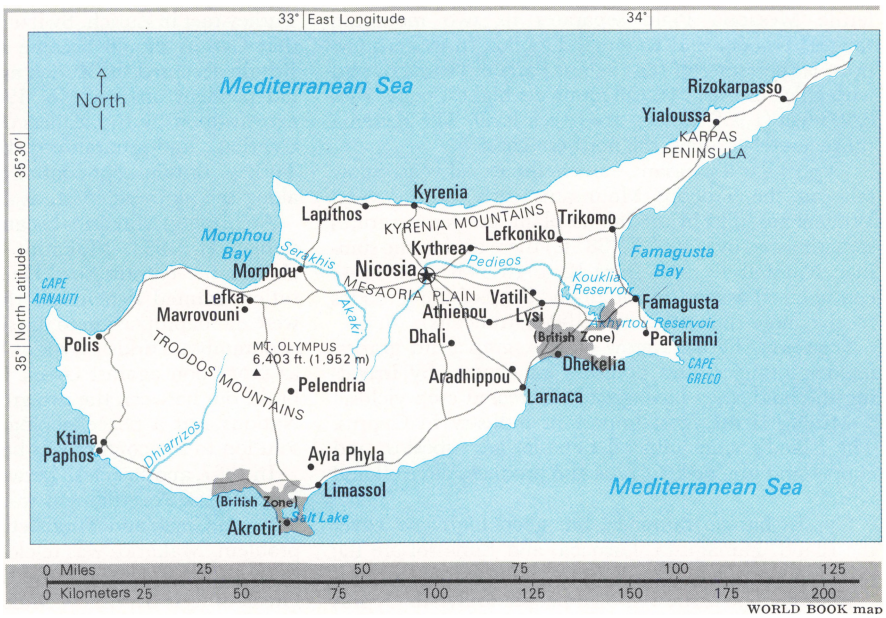
Capital

Other City or Town

Road

MOUNTAIN

River



WORLD BOOK map

CYPRUS, *SY pruhs,* is an island republic in the northeast corner of the Mediterranean Sea. It lies about 40 miles (64 kilometers) south of Turkey and 60 miles (97 kilometers) west of Syria. Geographically, Cyprus is part of Asia. But its people live much like southern Europeans and have a standard of living second only to Israel's in the eastern Mediterranean area. Cyprus is a scenic country noted for its hilltop castles, old churches, beaches, and rugged mountains.

About four-fifths of the people in Cyprus are of Greek origin, and most of the rest are of Turkish origin. Nearly all of the people regard themselves as Greeks or Turks rather than as *Cypriots* (citizens of Cyprus). Conflicts between these two groups have caused problems in Cyprus.

Cyprus became independent in 1960. Its official name is Kypriaki Dimokratia in Greek and Kibris Cumhuriyeiti in Turkish (Republic of Cyprus). Nicosia is the capital and largest city (see Nicosia).

Government. According to the 1960 Constitution, the president serves as head of state and government. The president must be a Greek Cypriot, elected by Greek Cypriots. The vice-president must be a Turkish Cypriot, elected by Turkish Cypriots. The Constitution also provides for a division of power between Greek and Turkish Cypriots in the legislature and in other government institutions. But various conflicts between Greek and Turkish Cypriots have made the island's government ineffective. In 1974, fighting between Turks and Greek Cypriots led to a complete breakdown of the government. Talks were begun to try to develop a new form of government for Cyprus.

People. About half of the people make their living by farming. Most of the people in the villages live in simple houses built around a courtyard. Most houses in the cities are more modern. Large apartment house units are replacing houses in many cities. Some older Cypriot men in rural areas wear richly decorated vests and baggy black trousers called *vrakas.* Some of the women wear long skirts and short blouses called *sarkas.*

Over 90 per cent of the people can read and write. Cyprus has separate schools for students of Greek and Turkish origin. Elementary education is free and compulsory for children from 6 to 12 years of age. Cyprus has technical schools and a teacher training academy.

Most of the Greeks are Christians and belong to the independent Orthodox Church of Cyprus. Most of the Turks are Moslems.

Land. Cyprus is an island of great scenic beauty. Its long and varied coastline alternates between rugged rock formations and golden sandy beaches. The broad,

The contributor of this article, Francis Noel-Baker, is a former member of the British Parliament and author of many articles and publications on Greece and Cyprus.

FACTS IN BRIEF

Capital: Nicosia.

Official Languages: Greek and Turkish.

Form of Government: Republic. *Head of State*—President.

Area: 3,572 sq. mi. (9,251 km²). *Greatest Distances*—east-west, 128 mi. (206 km); north-south, 75 mi. (121 km).

Population: *Estimated 1976 Population*—671,000; distribution, 51 per cent rural, 49 per cent urban; density, 189 persons per sq. mi. (73 per km²). *1960 Census*—577,615. *Estimated 1981 Population*—705,000.

Chief Products: *Agriculture*—barley, carrots, grapefruit, grapes, lemons, oranges, potatoes, wheat. *Mining*—asbestos, copper, gypsum, iron. *Manufacturing*—cement, cigarettes, furniture, olive oil, shoes, textiles, wines.

Flag: The flag is white with a map of Cyprus in copper-yellow (for copper) in the center above two green crossed olive branches (for peace). See Flag (color picture: Flags of Asia and the Pacific).

Money: *Basic Unit*—Cyprus pound. See Money (table).

fertile Mesaoria Plain separates its two mountain ranges, Troodos and Kyrenia. Troodos, in western Cyprus, is the larger of the ranges. Parts of it are covered with thick forests. Mt. Olympus, its highest peak, rises 6,403 feet (1,952 meters) above sea level. The Kyrenia range stretches along the northern coast.

Cyprus has a pleasant, sunny climate all year. Snow falls on the Troodos Mountains early in the year. Winters are mild in the inland plain, but temperatures sometimes go over 100° F. (38° C) there during the summer. Rainfall averages from 12 to 16 inches (30 to 41 centimeters) a year on the plain. Parts of the Troodos receive more than 40 inches (100 centimeters).

Economy. Farmers grow carrots, grapefruit, grapes, lemons, oranges, and potatoes for export. By irrigating the land, they have greatly increased crop yields.

Mining is the most important industry in Cyprus. The island's chief mineral deposits are asbestos, and copper and iron ores. Cyprus also produces olive oil and wines.

Cyprus has no railroads, but good highways cover the island. Famagusta, Larnaca, and Limassol are the principal ports, and Nicosia has an international airport.

History. The earliest known people to live in Cyprus date back to about 6000 B.C. Greek settlers arrived there about 1200 B.C., and started city-states similar to those in ancient Greece (see GREECE, ANCIENT [The City-State]). Before the time of Christ, the Assyrians, Egyptians, Persians, Greeks, and Romans conquered Cyprus. Saint Paul and Saint Barnabas brought Christianity to the island in A.D. 45. In A.D. 330, Cyprus became a part of the Byzantine Empire. Richard the Lion-Hearted of England captured Cyprus in 1191, but he sold it to a French nobleman. The Ottoman Turks invaded Cyprus in the 1570's, and ruled Cyprus until they turned the island over to Great Britain in 1878. Great Britain declared the island a Crown Colony in 1925.

In the 1950's, Greek Cypriots, under the leadership of Archbishop Makarios, started the campaign for *enosis* (union with Greece). A Greek Cypriot secret organization called *EOKA* started guerrilla attacks on the British. Britain declared a state of emergency on the island in 1955, and in 1956 exiled Makarios to the Seychelles Islands in the Indian Ocean. Greece and Turkey met in Zurich, Switzerland, in 1959, and agreed that Cyprus should become an independent republic. Britain accepted the Zurich agreement. Cyprus became independent on Aug. 16, 1960, under a constitution agreed upon by the leaders of the Greek and Turkish Cypriots, and guaranteed by Britain, Greece, and Turkey. Britain kept control of two military base areas along the southern coast, at Akrotiri and Dhekelia.

Archbishop Makarios became president of the new republic. In 1963, Makarios announced proposals to change the constitution. He claimed that the constitution granted benefits to the Turkish Cypriots that were out of proportion to the size of the Turkish Cypriot community. Turkish Cypriot leaders saw these benefits as protection against Greek Cypriot control. Fighting broke out between the two groups. In 1964, the United Nations sent a peacekeeping force to Cyprus while a solution to the conflict was being worked out.

In 1967, another clash between the two groups caused a new crisis. A settlement was reached, but differences between Greek and Turkish Cypriots continued to be a problem. Makarios was re-elected in 1968 and 1973.

In July, 1974, Cypriot national guard forces led by Greek officers overthrew Makarios, who then fled from Cyprus. Nikos Sampson, a newspaper publisher, became president. But he resigned after a week, and Glafkos Clerides, president of the Cypriot House of Representatives, took over the presidential duties.

After the overthrow of Makarios, Turkey invaded Cyprus. Widespread fighting occurred between the Turks and Greek Cypriots, and the Turks captured large amounts of territory. A series of cease-fires was negotiated to end the fighting. Makarios returned to Cyprus in late 1974. But the Turkish Cypriots refused to recognize him as president, and they later declared the Turkish-held territory a separate state. Representatives of Greece and Turkey met in 1974 and 1975 to try to resolve the crisis and establish a new form of government for Cyprus. Greek Cypriot and Turkish Cypriot leaders also held talks. FRANCIS NOEL-BAKER

See also MAKARIOS, ARCHBISHOP; UNITED NATIONS (Conflict on Cyprus; picture: Peacekeeping Forces).

Authenticated News Int.

A Street Scene in Nicosia shows some of the small shops that are typical of older sections of the city. Many merchants display their goods on the storefronts. This street is in the Greek section of Nicosia.

CYRANO DE BERGERAC, *see rah NO duh BEHR zhuh RAHK*, **SAVINIEN DE** (1619-1655), was a French author and soldier. He was also known for his skill in sword fighting and for his long nose. Edmond Rostand's famous play *Cyrano de Bergerac* (1897) contains a somewhat fanciful account of Cyrano's colorful life.

Cyrano wrote a comedy *The Ridiculous Pedant* (1653) and a tragedy *The Death of Agrippina* (1654). But his most famous books are two science fiction works: *The Other World, or the States and Empires of the Moon* (1657) and *The States and Empires of the Sun* (1662). A free thinker, he questioned traditional religious beliefs and the church's authority. He also said animals have intelligence and that matter is made up of atoms.

Cyrano was born in Périgord. Twice wounded in battle, he left military life in 1642 to study science and literature in Paris. JULES BRODY

CYRENAICA. See LIBYA (History).

CYRIL OF ALEXANDRIA, SAINT (A.D. ? -444), presided over the Council of Ephesus which condemned Nestorius in 431. He served as Patriarch of Alexandria from 412, and did much to shape Catholic doctrine on the Trinity and the Person of Christ. He was born in Alexandria. WALTER J. BURGHARDT

CYRIL OF JERUSALEM, SAINT (A.D. 315?-386), played a prominent part in the struggles regarding the Trinity in the mid-300's (see TRINITY). He was banished from Jerusalem three times for opposing Arianism (see ARIANISM). He was one of 150 orthodox bishops at the Council of Constantinople in 381. He was born near Jerusalem. WALTER J. BURGHARDT

CYRILLIC ALPHABET. See ALPHABET (Other Systems); RUSSIAN LANGUAGE.

CYRUS THE GREAT (reigned 559-529 B.C.), sometimes called CYRUS THE ELDER, founded the ancient Persian Empire. His ancestors had been vassals of the Median kings, ruling Anshan near the Persian Gulf.

There is a legend that Cyrus' grandfather Astyages tried to have him killed when an infant. Astyages feared that he might be overthrown by his grandson. Cyrus was protected by a shepherd and was eventually restored to his parents. When he grew up, he formed an army of Persians, overthrew his grandfather, and became king of Media and Persia. He made himself master of Lydia by defeating Croesus in 546 B.C. A few years later, he defeated Nabonidus, King of Babylon.

Cyrus was a wise, generous ruler. He permitted the Jews to return to Jerusalem from captivity in Babylonia. He took the title *King of the World*, and tried to organize his lands. RICHARD NELSON FRYE

CYRUS THE YOUNGER (424?-401 B.C.), a Persian prince, was a son of King Darius II, ruler of the Achaemenid Empire. Cyrus served as *satrap* (governor) of a province in Asia Minor. Darius died in 404 B.C., and Cyrus' older brother Artaxerxes became king. Cyrus revolted against Artaxerxes, and tried to seize the throne. He led 10,000 Greek *mercenaries* (hired troops) into Babylonia, where he fought his brother in 401 B.C. at the Battle of Cunaxa. Cyrus was killed, and the leaders of his forces imprisoned. The Greek mercenaries fled. The story was told by the Greek historian Xenophon in *Anabasis* (see XENOPHON). RICHARD NELSON FRYE

CYST, *sihst*, is a sac in the body that contains fluid and has no outside opening. Cysts of the skin occur more often than others. These usually form when the opening of an oil gland becomes blocked. Some cysts are formed around a foreign substance which gets into the body, while others form around blood, following an injury. A cyst that forms in the salivary gland under the tongue is called a *ranula*. Cysts of internal organs are usually caused by abnormal development of the organ. Cysts are removed by surgery. See also WEN. JOHN B. MIALE

CYSTIC DUCT. See GALL BLADDER.

CYSTIC FIBROSIS, *SIHS tihk fy BROH sihs*, is a hereditary disease in which the lungs, liver, and pancreas secrete large amounts of thick mucus. A cystic fibrosis patient has difficulty breathing because mucus clogs his lungs. He cannot digest his food completely because plugs of mucus prevent the liver and the pancreas from secreting their digestive enzymes. The blockage by mucus also damages tissues in the organs involved. Many victims die of lung infections. Cystic fibrosis, also called *mucoviscidosis*, cannot be cured.

Scientists do not know the exact nature of the inherited defect that causes cystic fibrosis. Physicians diagnose the disease by testing the patient's perspiration. Persons with cystic fibrosis have large amounts of salt in their perspiration, saliva, and tears, particularly the perspiration.

Doctors use drugs to fight infections caused by cystic fibrosis. Digestion can be improved by pills that contain the missing enzymes. Many patients inhale water mist to thin the mucus in their lungs. Some sleep under plastic *mist tents*, into which water and infection-fighting drugs are sprayed. A. WILLIAM HOLMES

CYSTITIS. See BLADDER.

CYTOCHROME. See IRON (How Our Bodies Use Iron).

CYTOLOGY, *sy TAHL oh jih*, is the study of the internal structure and organization of cells. Microscopic studies of the structure of the cell provided an explanation of cell division, and served as a foundation for genetics (see GENETICS). These studies also showed that each structure in the cell has some function, and that each activity of the cell is related to changes in the chemicals that make up the cell. *Cytochemistry* is the study of the chemical activities that take place inside cells. See also CELL. NEAL D. BUFFALOE

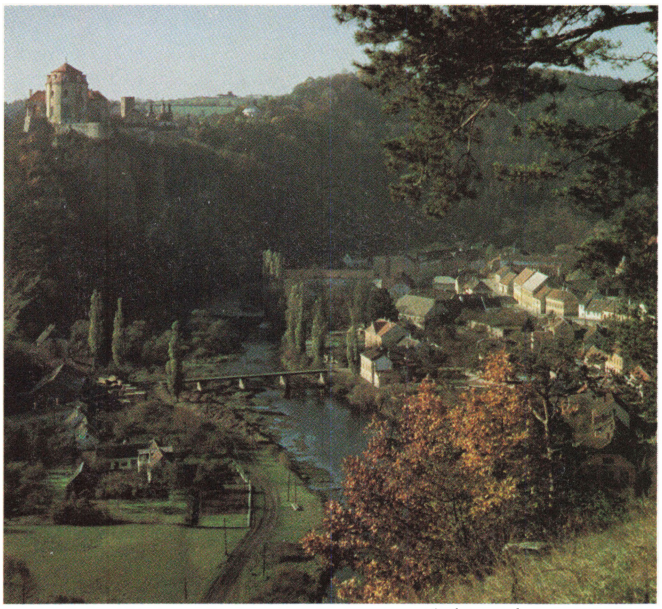
CYTOPLASM. See CELL (Inside a Living Cell); PROTOPLASM; BLOOD (Platelets).

CZAR, *zahr*, was the title used by the emperors of Russia. *Czar* comes from *Caesar*, the name used by the emperors of Rome. The first Russian ruler to adopt the title was Ivan the Terrible, in 1547. The last czar was Nicholas II (1868-1918). The Russian empress was called the *czarina*, and the crown prince was called the *czarevitch*. See also CAESAR; KAISER.

CZECH, *check*, is a Slavic person, usually found in two Czechoslovak provinces, Bohemia and Moravia. More than half the population of Czechoslovakia is Czech. The rest of the people are chiefly Slovak. The Czechs are descendants of early Slavic immigrants.

At one time, all the Slavic peoples spoke the same language. The Czechs, however, gradually developed a separate language that includes many German, Latin, and English words. Dialects are found in Bohemia, Moravia, Silesia, and Slovakia. WILTON MARION KROGMAN

See also CZECHOSLOVAKIA (People).



Alphapress from Jeroboam, Inc.

Elliott Erwitt, Magnum

Czechoslovakia is a scenic country in central Europe. Historic castles and picturesque villages, such as Vranov nad Dyje, *left*, add to the beauty of the Czechoslovak countryside. But most Czechoslovaks live in cities and towns. Prague, *right*, is the country's capital and largest city.

CZECHOSLOVAKIA

CZECHOSLOVAKIA, *cheh kuh sloh VAH kih uh*, is a landlocked country in the heart of central Europe. It is the home of two closely related groups of Slavic peoples—the Czechs and the Slovaks. Most of the Czechs live in Bohemia and Moravia, two industrialized regions in western Czechoslovakia. The Slovaks live primarily in Slovakia, a more agricultural area in the east. Prague is Czechoslovakia's capital and largest city.

Rugged mountains, rolling hills, and fertile plains cover Czechoslovakia. The country has about the same area as New York, but it has only about three-fourths as many people as that state. Czechoslovaks have a higher standard of living than most of the people of Eastern Europe. More than half the people live in urban areas. More of them work in manufacturing industries than in any other economic activity. Coal and other natural resources have helped make Czechoslovakia an industrial nation. The country also produces a variety of agricultural products.

Czechoslovakia gained independence in 1918, when the Czechs and Slovaks united to form a single nation. Before that, Bohemia, Moravia, and Slovakia had been part of Austria-Hungary.

In 1948, Czechoslovakia became a Communist state. The Communists reorganized the country's economy and government and patterned them after those of Russia. In 1968, the Czechoslovak government began a reform program to give the people more freedom. But troops from Russia and four other European Communist nations invaded Czechoslovakia and ended the reform program.

Today, Czechoslovakia remains a loyal member of the *Soviet bloc*, a group of Communist nations led by Russia. The countries of the Soviet bloc provide Czechoslovakia with most of its imported goods, and they serve as markets for many of its exports.

Vojtech Mastny, the contributor of this article, is Associate Professor of History at the University of Illinois at Urbana-Champaign and author of The Czechs Under Nazi Rule: The Failure of National Resistance, 1939-42.

FACTS IN BRIEF

Capital: Prague.

Official Languages: Czech and Slovak.

Official Name: Československá Socialistická Republika (Czechoslovak Socialist Republic).

Form of Government: Socialist republic (Communist dictatorship).

Area: 49,371 sq. mi. (127,869 km²). *Greatest Distances*—east-west, 470 mi. (756 km); north-south, 235 mi. (378 km).

Elevation: *Highest*—Gerlachovka peak, 8,707 ft. (2,654 m) above sea level. *Lowest*—308 ft. (94 m) above sea level, near the Bodrog River on the Hungarian border.

Population: *Estimated 1976 Population*—14,830,000; distribution, 54 per cent urban, 46 per cent rural; density, 300 persons to the sq. mi. (116 per km²). *1970 Census*—14,357,557. *Estimated 1981 Population*—15,280,000.

Chief Products: *Agriculture*—barley, cattle, hogs, hops, potatoes, sugar beets, wheat. *Manufacturing*—chemicals, glass products, machinery, military equipment, textiles, transportation equipment. *Mining*—coal.

National Anthem: "Kde domov můj?" ("Where Is My Homeland?"), combined with "Nad Tatrou sa blýská" ("Lightning Flashes over the Tatra").

Money: *Basic Unit*—koruna. For the value of the koruna in U.S. dollars, see MONEY (table: Values).

The 1960 Constitution of Czechoslovakia established the country as a socialist republic. A 1968 amendment to the Constitution divided Czechoslovakia into two sections—the Czech Socialist Republic (Bohemia and Moravia) and the Slovak Socialist Republic (Slovakia). Although the Constitution mentions various civil rights, the government restricts such liberties as freedom of speech and freedom of the press.

All Czechoslovak citizens 18 or older may vote in elections. Political activity is centered around the National Front, an organization that nominates all candidates for office. The National Front consists of the Czechoslovak Communist Party; four other political parties, and such groups as labor unions, women's clubs, and youth organizations. However, the Communist Party actually has complete control over the National Front and the government of Czechoslovakia.

The Communist Party. About 9 per cent of all Czechoslovaks belong to the Communist Party. Party members hold all important government positions. In theory, the *Party Congress* is the highest authority of the Communist Party. Party regulations call for the congress to meet every five years to establish programs and policies. In between its sessions, the *Central Committee* is supposed to handle party affairs. In reality, however, the *Presidium* serves as the policy-making body of both the party and the country. The Presidium consists of a small group of party leaders. The *general secretary* of the party heads the Presidium. He is the most powerful person in the country.

National Government. Czechoslovakia has a two-house legislature called the Federal Assembly. It consists of the House of Nations and the House of the People. The House of Nations has 150 members—75 from each of the two socialist republics. The House of the People consists of 200 representatives elected from districts established on the basis of population. The members of both houses serve five-year terms.

The Federal Assembly elects the President of Czechoslovakia to a five-year term. He appoints the country's prime minister and Cabinet.

The Socialist Republics. The Czech Socialist Republic and the Slovak Socialist Republic each have a prime minister, Cabinet, and elected legislature. The republics have limited self-governing authority in such areas as education, health, and transportation.

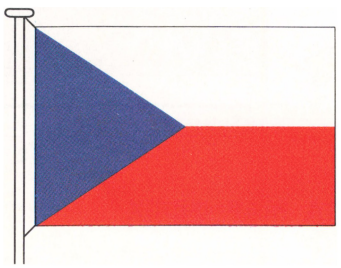
Local Government. Czechoslovakia is divided into 10 administrative regions, not including the cities of Bratislava and Prague, which form separate political units. The regions are subdivided into districts. *National committees* govern each of the regions and districts, as well as the cities and towns of Czechoslovakia.

Courts. The Supreme Court serves as the highest court of Czechoslovakia. There are also courts at the regional, district, and local levels.

Armed Forces of Czechoslovakia have a total of about 200,000 men. They serve in the National People's Army, which consists of air and ground forces and national guard units. Men may be drafted at age 18. Most of them serve two years. Czechoslovakia belongs to the Warsaw Pact, a military alliance made up of Russia and other European Communist nations.

Oldrich Karasek from Peter Arnold

The Federal Assembly Building in Prague is one of the city's most modern structures. It serves as the meeting place of Czechoslovakia's two-house legislature.



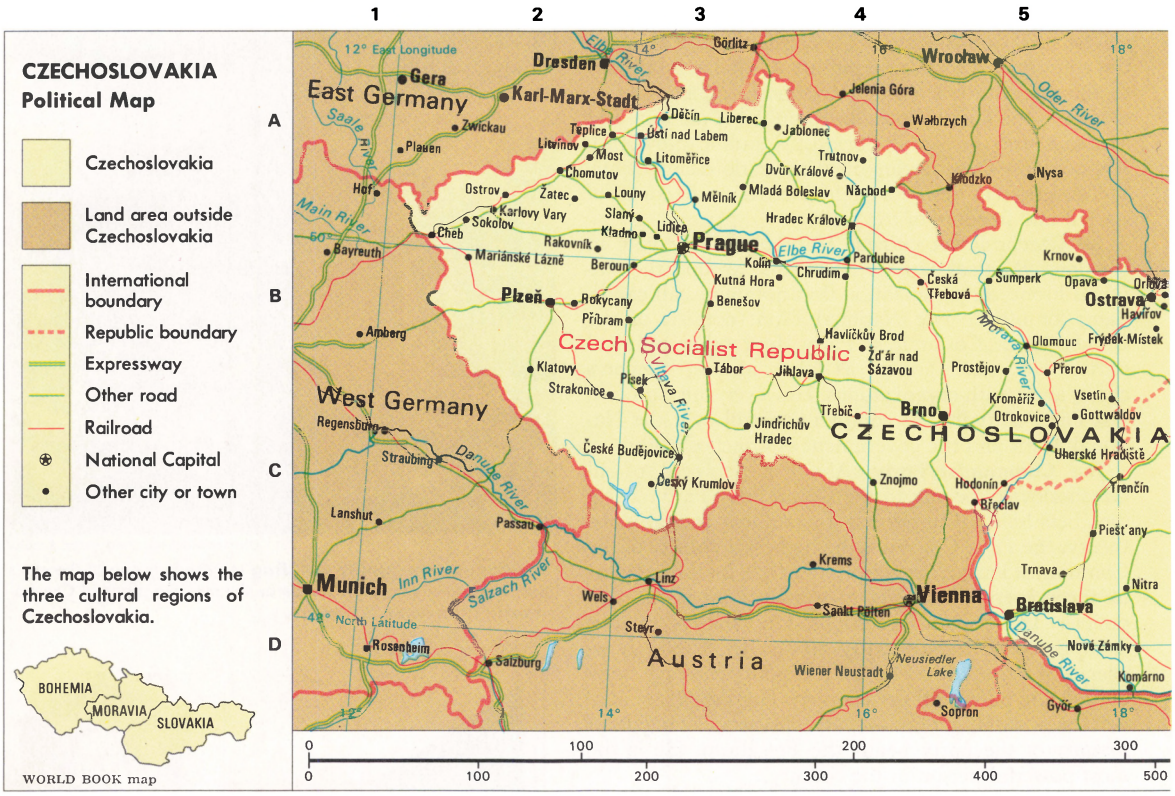
The Czechoslovak Flag is divided into three sections, representing the regions of Bohemia, Moravia, and Slovakia.

Coat of Arms features a two-tailed lion, a symbol of the historic Bohemian kingdom. The red star stands for Communism.

WORLD BOOK map

Czechoslovakia is a landlocked country in central Europe. It is surrounded by six major European countries.

CZECHOSLOVAKIA



CZECHOSLOVAKIA MAP INDEX

Republics

Name	Population	Area In sq. mi.	Area In km²	Capital	Map Key
Czech Socialist Republic	9,815,465	30,448	78,861	Prague	B 3
Slovak Socialist Republic	4,542,092	18,922	49,009	Bratislava	C 7

Population

1981 Estimate	15,280,000
1976 "	14,830,000
1970 Census	14,357,557
1961 "	13,745,577
1950 "	12,338,450
1947 Estimate	12,164,000
1930 Census	13,998,497
1921 "	13,003,446

Cities and Towns

Banská Bystrica	46,846	C 6
Bardejov	13,303	C 8
Benešov	10,776	B 3
Beroun	17,952	B 3
Bílina*	15,118	A 2
Brandýs nad Labem-Stará Boleslav*	15,354	B 3
Bratislava	283,539	D 5
Břeclav	13,531	C 5
Brezno	12,763	C 7
Brno	335,918	C 4
Čadca*	15,369	C 6
Carlsbad, see Karlovy Vary		
Česká Lípa*	17,008	A 3
Česká Třebová	14,086	B 4
České Budějovice	78,037	C 3
Český Krumlov	10,701	C 3
Český Těšín*	15,856	B 6
Cheb	26,051	B 1
Chomutov	40,561	A 2
Chrudim	17,650	B 4
Děčín	45,589	A 3
Dvůr Králové	16,220	A 4
Frýdek-Místek	39,790	B 6
Gottwaldov	65,216	C 5
Handlová	16,060	C 6
Havířov	81,317	B 6
Havlíčkův Brod	17,555	B 4
Hlohovec*	14,413	D 5
Hlučín*	12,893	B 6
Hodonín	20,829	C 5
Hradec Králové	69,587	B 4
Humenné	17,507	C 9
Jablonec	34,218	A 3
Jihlava	40,920	B 4
Jindřichův Hradec	12,960	C 3
Kadaň*	15,099	A 2
Karlovy Vary (Karlsbad)	43,708	B 2
Karviná	76,215	B 6
Kladno	58,069	B 3
Klatovy	17,828	B 2
Kolín	26,769	B 3
Komárno	27,031	D 6
Košice	145,027	C 8
Kralupy*	14,280	B 3
Krnov	22,496	B 5
Kroměříž	22,308	C 5
Kutná Hora	18,097	B 3
Levice	17,298	D 6
Liberec	72,752	A 3
Lidice	505	B 3
Liptovský Mikuláš*	16,550	C 7
Litoměřice	20,078	A 3
Litvínov	22,492	A 2
Louny	13,687	A 2
Lučenec	21,308	D 7
Mariánské Lázně (Marienbad)	13,402	B 2
Martin	32,237	C 6
Mělník	16,052	A 3
Michalovce	22,066	C 9
Mladá Boleslav	31,086	A 3
Most	54,875	A 2
Náchod	19,091	A 4
Nitra	45,908	D 6
Nové Mesto nad Váhom*	14,906	C 5
Nové Zámky	25,332	D 6
Nový Bohumín*	13,356	B 6
Nový Jičín*	19,817	B 6
Nymburk*	13,250	B 3
Olomouc	79,931	B 5
Opava	50,194	B 5
Orlová	24,286	B 6
Ostrava	278,737	B 6
Ostrov	18,033	A 2
Otrokovice	11,916	C 5
Pardubice	71,774	B 4
Piešťany	22,963	C 5
Písek	22,994	C 3
Plzeň	148,032	B 2
Poprad	21,767	C 7
Považská Bystrica*	15,510	C 6
Prague (Praha)	1,078,096	B 3
Přerov	39,858	B 5
Prešov	44,722	C 8
Příbram	28,781	B 3
Prievidza	27,434	C 6
Prostějov	36,923	B 5
Rakovník	13,256	B 2
Rimavská Sobota*	14,927	D 7
Rokycany	12,711	B 2
Rožnava	11,701	C 8
Ružomberok	20,885	C 7
Šaľa*	12,974	D 5
Slaný	12,483	B 3
Sokolov	20,690	B 2
Spišská Nová Ves	22,581	C 8
Strakonice	17,795	C 2
Šumperk	23,588	B 5
Svitavy*	14,636	B 4
Tábor	22,236	B 3
Teplice	51,374	A 2
Topoľčany*	13,935	C 6
Třebíč	21,554	C 4
Trebišov	12,710	C 8
Trenčín	28,859	C 6
Třinec	30,080	B 6
Trnava	38,393	D 5
Trutnov	24,892	A 4
Uherské Hradiště	16,456	C 5
Ústí nad Labem	72,299	A 3
Valašské Meziříčí*	17,424	B 6
Varnsdorf*	13,927	A 3
Vsetín	22,593	C 6
Vyškov*	13,967	C 5
Žatec	15,725	A 2
Žďár nad Sázavou	15,489	B 4
Žilina	50,792	C 6
Znojmo	26,538	C 4
Zvolen	27,290	C 6

*Does not appear on the map; key shows general location.

Source: 1970 census.

V. Lefteroff, DeWys, Inc.

Crowds of Czechoslovaks relax on the beach at Doksy, a resort town north of Prague. Czechoslovakia is a landlocked country. But small lakes provide facilities for swimming, sailing, and other water sports. Czechoslovaks also enjoy camping and hiking.

CZECHOSLOVAKIA / *People*

Population and Ancestry. Czechoslovakia has a population of about 14,830,000 persons. About 65 per cent of the people are Czechs, and about 30 per cent are Slovaks. Hungarians make up the largest minority group in Czechoslovakia. Other minorities include Germans, Gypsies, Poles, and Ukrainians.

The Czechs and Slovaks are descendants of Slavic tribes that settled in what is now Czechoslovakia in the A.D. 400's. Through the years, the Czech culture was influenced by the Germans, many of whom lived in Bohemia and Moravia. The Slovaks were influenced by the *Magyars* (Hungarians), who ruled Slovakia after the 800's. During the 1800's, Bohemia and Moravia became industrial centers. But Slovakia remained agricultural.

When Czechoslovakia was formed in 1918, the Czechs and Slovaks came together to form a single nation. But many Slovaks resented the Czechs' control over the government and economy. Since the mid-1900's, the country's Communist leaders have worked to give the Slovaks greater representation in the government and to develop the economy of Slovakia.

About 54 per cent of the people of Czechoslovakia live in urban areas. Prague, the capital, is the only city with more than a million people. Three other cities have populations of more than 250,000. They are, in order of size, Brno, Bratislava, and Ostrava. See the separate articles on Czechoslovak cities listed in the *Related Articles* at the end of this article.

Languages. Czechoslovakia has two official languages—Czech and Slovak. Both are Slavic languages, closely related to other languages of Eastern Europe. Czech and Slovak are so similar that a speaker of one can usually understand a speaker of the other. Members of Czechoslovakia's minority groups use their own language among themselves. But most of them know Czech or Slovak as well.

Way of Life. The Czechoslovaks have one of the highest standards of living in Eastern Europe. Many families have such luxury items as television sets and refrigerators. Nearly a fifth of the families own cars.

Since the mid-1900's, more and more people have moved to the cities and have taken jobs in industry. Many old traditions, such as colorful folk costumes, have disappeared from everyday life. Today, Czechoslovaks dress much as people in the United States do. They wear folk costumes only for special events.

Like many other countries, Czechoslovakia has a severe housing shortage. Most of the country's city dwellers live in apartments. Many people in rural areas live in small, modern homes. But some people still live in old wooden houses decorated with colorful, hand-carved designs.

Food and Drink. Czech cooking is similar to that of Austria and Germany, and Slovak food resembles that of Hungary. A favorite Czechoslovak meal consists of roast pork, dumplings, and sauerkraut. Other popular foods include fruit-filled dumplings and creamy pastries. Carp is the traditional Christmas dish. Czechs enjoy beer with their meals, but many Slovaks prefer wine.

Recreation. Many Czechoslovaks, especially in rural areas, like to spend some of their free time in local *hospodas* or *krčmas* (taverns). The hospodas and krčmas

serve as social centers, where people come to talk with friends over a glass of beer or wine. Czechoslovaks also enjoy soccer games, motion pictures, and television. Large crowds attend ballets, concerts, operas, and plays in Prague, the leading cultural center of Czechoslovakia. Many Czechoslovaks take vacations and weekend trips to the country's scenic mountain and forest regions. Camping and hiking are favorite outdoor activities.

Religion. In the past, religion played an important role in the area that makes up present-day Czechoslovakia. But after the Communists came to power in Czechoslovakia in 1948, they began an antireligion campaign. Many priests and ministers were imprisoned, and the government took control of the churches.

The Czechoslovak Constitution guarantees religious freedom, but the government discourages religious practice. About two-thirds of the people are Roman Catholics, but only a small number attend church. About 12 per cent belong to various Protestant groups, including the Czechoslovak National Church and the Czech Brethren. Other religious groups include Jews and members of the Czechoslovak Orthodox Church.

Education. Nearly all the people of Czechoslovakia can read and write. Education is free, and the government operates all schools. Children must attend school from age 6 to 15. After graduating, a student may attend a specialized art or vocational school or a four-year general education school. The general education schools prepare students for university work.

Czechoslovakia has six universities. Prague is the home of one of the oldest universities in Europe—Charles University. It was founded in 1348 by the Holy Roman Emperor Charles IV.

The Arts. The Czechs and Slovaks are known for their love of music, and both groups have rich traditions of folk songs and dances. A number of Czech composers have gained worldwide fame. They include Bedřich Smetana (1824-1884), Antonín Dvořák (1841-1904), and Leoš Janáček (1854-1928).

Eric Lessing, Magnum

Colorful Folk Costumes add to the gaiety of special celebrations in Czechoslovakia. But most Czechoslovaks, especially city dwellers, usually wear Western-style clothing.

James H. Karales from Peter Arnold

Neighborhood Cafés are popular meeting places where Czechoslovaks like to relax with friends. The waitress above is serving world-famous Czech beer, a favorite national beverage.

E. Henriksson from Carl Östman

Small Towns and Villages dot the countryside throughout Czechoslovakia. Many of them were settled during the Middle Ages, but they now have electricity and other modern conveniences.

The earliest examples of Czech literature still in existence are religious works written in the 1200's. Czech and Slovak writing flourished during the 1800's, when numerous authors took part in a movement to develop the national identities of the Czech and Slovak peoples. Outstanding authors of the 1900's include Franz Kafka (1883-1924) and Karel Čapek (1890-1938). Under the Communists, the government has imposed sharp restrictions on authors who criticize the Communist system. As a result, most present-day literature supports the ideas and goals of Communism.

Some of Czechoslovakia's finest paintings and sculptures date from the Middle Ages, when local artists produced beautiful religious works. In the 1700's, baroque architecture reached a high level of development in the country. Many castles, churches, and other buildings were constructed in this elaborate style.

Motion pictures are a popular art form in Czechoslovakia. The center of the Czechoslovak film industry is at Barrandov, near Prague.

Czechoslovakia covers 49,371 square miles (127,869 square kilometers) in central Europe. The country can be divided into seven land regions: (1) the Bohemian Mountains, (2) the Sudetes Mountains, (3) the Bohemian Basin, (4) the Bohemian-Moravian Highlands, (5) the Moravian Lowlands, (6) the Danubian Lowlands, and (7) the Western Carpathians.

The Bohemian Mountains are a series of ranges in western Czechoslovakia. They include the Ore Mountains in the northwest and the Bohemian Forest in the southwest. Much of this area consists of hills that rise to more than 2,500 feet (762 meters) above sea level.

Large deposits of coal and uranium ore lie in the Ore Mountains. Manufacturing and mining industries employ many of the people who live in this heavily populated area. Farmers in the Bohemian Mountains raise a variety of crops and livestock. This region also has ski slopes, and such famous health resorts as Karlovy Vary and Mariánské Lázně, where people come to bathe in mineral springs.

The thickly wooded peaks of the Bohemian Forest are an important source of lumber and other wood products.

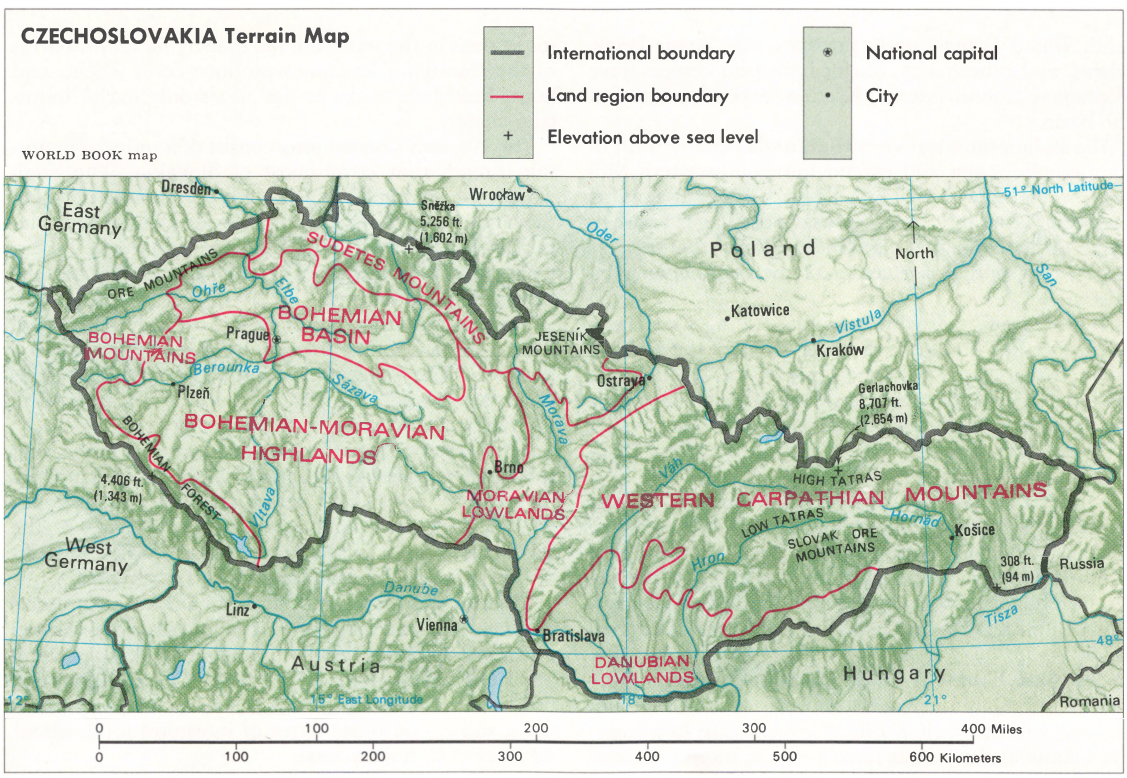
The Sudetes Mountains border north-central Czechoslovakia. In general, they are higher and more rugged than the Bohemian Mountains. Like the Bohemian Mountains, the Sudetes region has many industrial cities and towns, as well as agricultural areas, forests, and resorts.

Oldrich Karacek from Peter Arnold

The Sudetes Mountains separate northern Czechoslovakia from Poland. In winter, the snow-covered peaks attract many skiers.

The Bohemian Basin is a low-lying area of plains and rolling hills that occupies north-central Bohemia. Numerous rivers and streams that originate in the surrounding highlands flow into the basin and meet near Prague. Major rivers include the Vltava, which flows northward toward Prague; and the Elbe, which flows westward across the basin before it enters East Germany.

The Bohemian Basin has large areas of fertile farm-



Kramarz, FPG

Fertile Farmland is one of Czechoslovakia's most important natural resources. The country's best soil lies along the river valleys of northern Bohemia, central Moravia, and southern Slovakia. Most Czechoslovak farmers, such as the women above, work on large farms managed by the government.

land, where farmers grow potatoes, rye, sugar beets, wheat, and other crops. Major industrial centers have developed around Prague, Kladno, and other cities of the basin.

The Bohemian-Moravian Highlands occupy most of southern Bohemia and extend into southwestern Moravia. This region of low hills and plateaus consists mainly of farmland. Small towns and villages are scattered throughout the highlands. Plzeň, the region's largest city, is a major center of the beer-brewing industry.

The Moravian Lowlands span central Czechoslovakia. Fertile farmland covers the valley of the Morava River, which flows from north to south through the lowlands. The Dyje River crosses the southern end of the district. Farmers in the lowlands grow such crops as corn, potatoes, rye, sugar beets, and wheat. Many farmers also raise cattle.

Much of the Moravian Lowlands region is densely populated. Brno, an industrial city in the southwest, ranks as the second largest city of Czechoslovakia. One of Czechoslovakia's leading industrial and mining centers lies in the northeast, around the city of Ostrava. This region has Czechoslovakia's most important coal fields.

The Danubian Lowlands cover southwestern Slovakia. The Danube River forms part of the southern boundary of this region. Like the Moravian Lowlands, the Danubian Lowlands have fertile farmland, though some areas in the south are too marshy for crops. Farms in the Danubian Lowlands produce corn, wheat, and hogs. Bratislava ranks as the area's only major industrial center.

The Western Carpathians consist of a series of mountain ranges that cover most of Slovakia. The High Tatras are a chain of rugged peaks that border northern Slovakia. Gerlachovka, Czechoslovakia's highest mountain, rises 8,707 feet (2,654 meters) in the High Tatras. Other mountain ranges include the Low Tatras and the Slovak Ore Mountains.

Most of the Carpathians region is thinly populated. The mountain forests provide lumber and other wood products. The valleys and foothills are used for crops and pastureland. Iron ore deposits lie near Košice, the region's only major manufacturing center.

The Western Carpathians region has some of the most spectacular scenery in Czechoslovakia, and it is a popular summer and winter resort area. Mountain goats, wolves, and other wild animals live in parts of the region, especially in the High Tatras. Many varieties of fish thrive in the mountain lakes and streams.

Climate. Most of Czechoslovakia has warm summers and cold winters. In general, the lowlands are warmer and drier than the mountainous areas. Average temperatures range from 29° F. (−2° C) in January to 66° F. (19° C) in July. The average annual *precipitation* (rain, snow, and other forms of moisture) totals about 28 inches (71 centimeters).

Czechoslovakia's economy is based largely on industry. Manufacturing and other industries employ nearly half of all Czechoslovak workers.

Before the 1800's, Bohemia, Moravia, and Slovakia were almost totally agricultural. But by the mid-1800's, industries had developed around the coal deposits of Bohemia and Moravia. When Czechoslovakia was formed in 1918, it ranked as a leading industrial nation of Europe, though Slovakia remained agricultural.

After the Communist Party gained control of Czechoslovakia in 1948, the government managed all aspects of the economy. The Communists developed industries in Slovakia, and they stressed the manufacture of *capital goods*, such as factory equipment. Production of *consumer goods*, such as refrigerators, lagged behind.

Poor economic planning, labor shortages, and other problems led to a slowdown in the nation's economic growth in the 1960's. Demands for reform caused the government to introduce a program that lessened its control over the economy. But the program ended after the Soviet invasion of 1968. Today, the government again has almost total control over the economy.

Natural Resources. Farmland covers about 55 per cent of Czechoslovakia. Forests occupy 35 per cent of the land. Czechoslovakia has large deposits of coal. The country also has small amounts of antimony, magnesium, mercury, and uranium.

Industry. Most of Czechoslovakia's industries are *heavy industries*, such as steel production and the manufacture of machinery and transportation equipment. Kladno, Košice, and Ostrava rank as the leading steel centers. Plzeň produces automobiles, buses, machinery, military equipment, and trucks. Prague and Strakonice are also major centers of heavy industry.

Light industries in Czechoslovakia include food processing and the manufacture of glass and textiles. The brewery at Plzeň produces world-famous beer. Northern Bohemia has been a leading center of the glass industry since the 1600's. Brno, Liberec, and many smaller cities and towns have textile plants.

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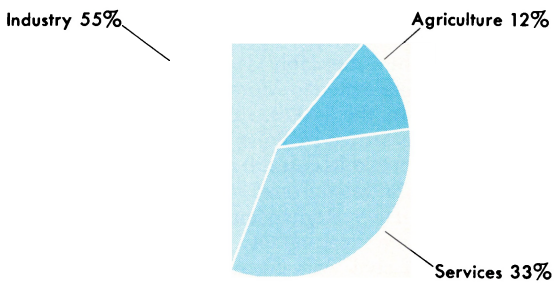
Manufacturing Industries employ more Czechoslovak workers than any other economic activity. Most of the country's industrial output consists of capital goods, such as heavy machinery.

Agriculture. Czechoslovakia's best farmland lies along the river valleys of north-central Bohemia, central Moravia, and southern Slovakia. Farms in these areas produce barley, corn, rye, sugar beets, and wheat. In the highlands, farmers grow cereal grains, flax, and potatoes. Plants called *hops*, used in making beer, are grown in northwestern Bohemia. Many farmers raise beef and dairy cattle, hogs, poultry, and sheep. Livestock products account for slightly more than half the value of Czechoslovakia's agricultural production.

Collective farms and state farms occupy 90 per cent of Czechoslovakia's farmland. About 10 per cent consists of small plots owned by individual farmers. The collective farms average about 1,500 acres (607 hectares). The collective farm workers own the farm equipment and property, but the government determines farm policies. The workers are paid a share of the farm's earnings. The state farms average about 10,500 acres (4,249 hectares). The government owns and operates the

CZECHOSLOVAKIA'S GROSS NATIONAL PRODUCT

Total gross national product in 1972—$40,800,000,000



The Gross National Product (GNP) is the total value of goods and services produced by a country in a year. The GNP measures a nation's total annual economic performance. It can also be used to compare the economic output and growth of countries.

Production and Workers by Economic Activities

Economic Activities	Per Cent of GNP Produced	Employed Workers	
		Number of Persons	Per Cent of Total
Manufacturing, Mining, & Utilities	48	2,758,000	37
Agriculture & Forestry	12	1,196,000	16
Transportation	12	375,000	5
Trade	8	700,000	10
Construction	7	639,000	9
Housing	5	81,000	1
Government	5	1,279,000	17
Business, Community, & Personal Services	2	231,000	3
Communication	1	104,000	1
Banking & Insurance	*	36,000	1
Total	100	7,399,000	100

*Included in Business, Community, & Personal Services.

Sources: Federal Office of Statistics, Prague; Joint Economic Committee, Congress of the United States; Thad P. Alton, Director, Research Project on National Income in East Central Europe, New York, N.Y.

state farms, and the farm workers receive salaries.

Transportation and Communication. Czechoslovakia has about 45,000 miles (72,400 kilometers) of roads, most of which are surfaced. About 9,000 miles (14,000 kilometers) of railroad track link the cities and towns. The government owns and operates all means of transportation, including the country's one airline.

More than 25 daily newspapers are published in Czechoslovakia. There are 54 radio stations and 23 television stations. The government controls all means of communication in Czechoslovakia.

Foreign Trade. Czechoslovakia belongs to the Council for Mutual Economic Assistance (COMECON), an economic union of Communist nations. About 70 per cent of the country's trade is with Communist nations. Leading imports include iron ore, machinery, and petroleum. The chief exports are coal, machinery, metal products, textiles, and transportation equipment.

CZECHOSLOVAKIA / *History*

Prehistoric peoples lived in what is now Czechoslovakia thousands of years ago. By about A.D. 500, various Slavic tribes had settled in the area. During the A.D. 800's, several of the tribes united to form the Great Moravian Empire, which covered much of central Europe. The empire lasted until about 900, when the *Magyars* (Hungarians) conquered Slovakia. The Magyars ruled the Slovaks for the next thousand years. The rest of the empire broke up into smaller states.

The Rise of Bohemia began around A.D. 900. The Přemyslide family ruled the country for about 400 years. Under its rule, Bohemia became a semi-independent kingdom within the Holy Roman Empire. By the 1100's, Bohemia included Moravia and parts of Austria and Poland. In the 1200's, many German craftsmen and merchants settled in Bohemian towns.

Bohemia reached its cultural and political peak under Charles IV, who ruled from 1346 to 1378. Charles was also crowned Holy Roman emperor, and Prague became the empire's leading city.

A period of civil wars began in Bohemia after the death of John Huss in 1415. Huss had led a movement for reform in the Roman Catholic Church. He was burned at the stake as a heretic. His followers, called Hussites, fought loyal Roman Catholics from 1419 until 1436, when the two sides reached a compromise.

Photoworld, FPG

Tomáš G. Masaryk became Czechoslovakia's first president after the nation was created in 1918. Masaryk had been one of the leaders of the movement for Czechoslovak independence.

Beginning in the late 1400's, a series of weak Polish kings ruled Bohemia. During this period, Czech nobles increased their power over parts of the kingdom.

Hapsburg Rule. In 1526, the Hapsburg ruler of Austria, Ferdinand I, became king of Bohemia and Hungary. Under the Hapsburgs, Bohemia remained semi-independent, though the nobles lost some of their power.

During the 1500's, the Reformation gave birth to Protestantism in Europe. Although the Hapsburgs were Catholics, many Czechs became Protestants. In 1618, a group of Czech Protestant nobles revolted against Hapsburg rule. They elected a Protestant king of Bohemia. The Czech revolt touched off the Thirty Years' War, a series of wars that spread through Europe (see THIRTY YEARS' WAR).

In 1620, the Hapsburg armies defeated the nobles in the Battle of the White Mountain. Bohemia then lost its self-governing powers. It was divided into three provinces—Bohemia, Moravia, and Silesia—ruled by representatives of the Hapsburgs. The Hapsburgs forced the Czechs to adopt the German language and culture, and Catholicism became the state religion.

Prussia, which included parts of what are now East Germany, Poland, and Russia, conquered most of Silesia in 1741. But Bohemia, Moravia, and part of Silesia remained in the Austrian Empire. Beginning in the late 1700's, industries were developed in Bohemia and Moravia, and many Czech peasants moved to urban areas. By the mid-1800's, the Czechs had replaced the Germans as the largest population group in the

IMPORTANT DATES IN CZECHOSLOVAKIA

c. A.D. 500 Ancestors of the Czechs and Slovaks settled in what is now Czechoslovakia.

c. A.D. 900 The Magyars conquered Slovakia, and Bohemia developed into a powerful central European state.

1347 Charles IV of Bohemia became Holy Roman emperor.

1419-1436 The Hussite Wars brought turmoil to Bohemia.

1526 Bohemia became part of the Hapsburg Empire of Austria.

1618 A Czech revolt touched off the Thirty Years' War.

1918 The Czechs and Slovaks formed Czechoslovakia as an independent nation.

1938-1939 Germany seized control of Czechoslovakia.

1945 Czechoslovakia regained its independence.

1948 Communists took over the Czechoslovak government.

1968 The Czechoslovak government began a program of liberal reforms. Troops from Russia and other Communist nations invaded Czechoslovakia and ended the program.

Tanks Blocked the Streets of Prague in 1968, during an invasion by troops from other European Communist nations. The invasion ended a reform movement in Czechoslovakia.

Photoreporters, Inc.

cities and towns of Bohemia and Moravia. At about the same time, many Czechs began to promote a rebirth of the Czech language and culture. The growth of Czech national feeling led to demands for self-government. A similar movement developed in Slovakia, which belonged to the Austrian Empire as part of Hungary. But Slovakia's rulers stamped out the Slovak movement. In 1867, Austria and Hungary formed a monarchy called Austria-Hungary (see AUSTRIA-HUNGARY).

Independence. During World War I (1914-1918), revolutionary activity increased in Bohemia. The Hapsburg government arrested many revolutionary leaders. But two leading Czech nationalists—Tomáš G. Masaryk and Eduard Beneš—escaped from the country. In 1916, Masaryk, Beneš, and several other Czech and Slovak leaders formed the Czechoslovak National Council in Paris. The council worked to win foreign support for the idea of an independent state made up of Czechs and Slovaks.

In 1918, the Allies recognized the council as the provisional government of a new nation—Czechoslovakia. That year, Austria-Hungary collapsed, and Czechoslovakia was proclaimed an independent country, made up of Bohemia, Moravia, and Slovakia. In 1919, Ruthenia, a region east of Slovakia, became part of Czechoslovakia. The Czechoslovak Constitution established the country as a democratic republic. Masaryk served as president of Czechoslovakia from 1918 until 1935, when Eduard Beneš succeeded him.

During the 1930's, unrest began to spread among Czechoslovakia's minority groups. Although Czechs made up only about 51 per cent of the population, they controlled the economy and government. The Slovaks resented the Czech control. The *Sudeten Germans* (Germans who lived in the Sudetes Mountains of Czechoslovakia) also objected to Czech dominance.

German Seizure. Adolf Hitler's rise to power in Germany during the 1930's increased the minority tensions in Czechoslovakia. Hitler encouraged the Sudeten Germans to demand self-rule. He threatened to declare war on Czechoslovakia if the demand was not met.

In 1938, representatives of Britain, France, and Italy signed an agreement with Hitler that forced Czechoslovakia to give the Sudeten territory to Germany (see MUNICH AGREEMENT). Later that year, Hungary and Poland claimed parts of Czechoslovakia. In 1939, the Czechoslovak government surrendered to Hitler's demands for control over the rest of Czechoslovakia. German troops then occupied the country. Hitler made Bohemia and Moravia a German protectorate. Slovakia became a separate republic under German control.

The German occupation brought widespread suffering to Czechoslovakia during World War II (1939-1945). Uprisings against the Germans occurred in both Slovakia and the Protectorate of Bohemia and Moravia. More than 250,000 Czechoslovaks died during the war.

Eduard Beneš, who had fled from Czechoslovakia in 1938, formed a government-in-exile in London during the war. He cooperated with both the Western powers and Russia. In 1943, he signed a treaty of friendship and cooperation with the Soviet government. By 1945, the Soviet Army had freed most of Czechoslovakia from the Germans. United States troops liberated parts of Bohemia. After World War II ended in 1945, the government-in-exile returned, and all foreign troops withdrew from Czechoslovakia. That year, Czechoslovakia gave up Ruthenia under terms of a treaty with Russia.

Communist Rule. Beneš formed a coalition government to lead postwar Czechoslovakia. Communists held several important positions in the new government, which had Russian support. The government banned conservative political parties and took control of major industries. Thousands of Germans and Hungarians living in Czechoslovakia were forced to leave.

In national elections held in 1946, the Communist Party received 38 per cent of the vote—more than any other party. The Communist Party chairman, Klement Gottwald, became prime minister of Czechoslovakia. But in local elections held in 1947, the Communists won a smaller percentage of the vote than they had won in 1946. At the same time, conflicts erupted between the Communists and the other parties in the government.

In February, 1948, the Communists forced President Beneš to form a government made up entirely of Com-

munists and their supporters. Beneš resigned a few months later, and Gottwald succeeded him. The Communists then had complete control of the government.

The Communist take-over brought about revolutionary changes in Czechoslovakia. The government took over all businesses, industries, churches, and schools. Farmers were forced to join state farms or government-controlled cooperatives. The secret police imprisoned many Czechoslovaks who opposed the government.

During the early 1950's, divisions within the Communist Party led to a series of political trials. Many party officials were accused of treason and executed or imprisoned. Gottwald remained president of Czechoslovakia until 1953, when Antonín Zápotocký succeeded him. Antonín Novotný became president in 1957.

The 1960's. During the early 1960's, Czechoslovakia's agricultural and industrial production dropped, and there were shortages of food and other goods. Members of the Communist Party itself criticized the government's inability to reverse the economic decline. At the same time, Czechoslovak intellectuals called for more freedom of expression, and many Slovaks renewed their efforts to gain recognition for Slovak rights. In 1968, the Communist Party removed Antonín Novotný as party leader. Alexander Dubček, a Slovak, became party leader, and Ludvík Svoboda became president.

Under Dubček, the government introduced a program of liberal reforms. These included more freedom of the press and increased contacts with non-Communist nations. Dubček won popularity among Czechoslovaks for the reforms. But the leaders of Russia and other Eastern European nations feared that Dubček's program would weaken Communist control in Czechoslovakia. They also feared that people in other Communist countries would demand similar reforms. As a result, in August, 1968, troops from Russia, Bulgaria, East Germany, Hungary, and Poland invaded Czechoslovakia. Dubček agreed to let the Russian troops remain, but the other troops withdrew by late 1968.

In 1969, the Czechoslovak Communist Party, under pressure from Russia, replaced Dubček with Gustáv Husák, a less liberal Slovak Communist. Thousands of persons who had been active in the reform movement either resigned or were removed from the party.

Czechoslovakia Today is a tightly controlled Communist state and a loyal ally of Russia. The Husák government has canceled most of the Dubček reforms. Although some Czechoslovaks continue to oppose Communism, most of the people have outwardly accepted the Communist system. In the 1970's, Czechoslovakia faced such problems as inflation and a housing shortage. But increased imports of consumer goods contributed to a better standard of living for Czechoslovaks.

In 1975, President Svoboda left office because of poor health. Husák succeeded him and continued to serve as Communist party leader as well. VOJTECH MASTNY

CZECHOSLOVAKIA / *Study Aids*

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Čapek, Karel
Comenius, John A.
Cori
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Dvořák, Antonín
Heyrovský, Jaroslav
Husák, Gustáv
Huss, John
Janáček, Leoš
Kafka, Franz
Kubelik (family)
Masaryk (family)
Smetana, Bedřich

CITIES

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HISTORY

Austria (History)
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Outline

I. Government
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G. Education
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IV. Economy
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B. Industry
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V. History

Questions

What event in Bohemia touched off the Thirty Years' War?
Where are Czechoslovakia's major coal fields located?
Who is the most powerful person in the Czechoslovak government?
What two groups of people make up most of the population of Czechoslovakia?
What changes did the Communists bring about in Czechoslovakia after their take-over in 1948?
What is the National Front?
When was the Great Moravian Empire formed?
What is Karlovy Vary famous for?
What are Czechoslovakia's chief industrial products?
Who was John Huss? Tomáš G. Masaryk?

CZERNY, *CHER nee*, **KARL** (1791-1857), an Austrian piano teacher and composer, is remembered chiefly for his piano studies. Many of his best compositions are collected in the *Complete Theoretical and Practical Pianoforte School*. He studied with Ludwig van Beethoven, and taught such famous pianists as Franz Liszt. Czerny was born in Vienna. ROBERT U. NELSON

CZOLGOSZ, LEON. See MCKINLEY, WILLIAM (Assassination).